AN ANALYSIS OF ALTERNATIVE MODELS FOR FUNDING HANDICAPPED PUPIL TRANSPORTATION

By

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To Bob, Hilary, and Jessie

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The purpose of this study was to determine the most equitable method for distributing funds for the transportation of handicapped children to public schools in the state of Florida. The current Florida pupil transportation formula does not differentiate between regular and special education students.

The present study was undertaken to determine (a) the cost of special education transportation services for districts in Florida and (b) whether the existing formula adequately funded these district costs. A stratified sample of 30 school districts was used as a data base for the study. The following data were gathered from each of the

30 counties for the 1982-83 school year:

1. mileage for regular and handicapped students;

2. total transported membership for both regular and handicapped students; and

3. cost figures for fuel, maintenance, and salaries on all handicapped student buses.

From these data, density indices were computed for both regular and handicapped students, as well as cost per pupil transported for the two populations.

The current Florida pupil transportation formula and an alternative linear regression model were then tested using three different populations: (a) all students transported, (b) regular students transported, and (c) handicapped students transported. Polynomial variables were added to each of the original models. Density was the independent variable. Cost per pupil transported for each of the three populations became the dependent variable.

The following results were achieved:

1. With all students transported, density is the single best predictor of cost per pupil.

2. Density is a strong predictor of regular student transportation costs but a poor predictor of handicapped student transportation costs.

3. Inefficiency in the operation and management of handicapped student transportation programs might be a chief factor in the variation of costs for handicapped transportation.

Results indicate that variation in district costs for special education transportation warrants

1. the study of school transportation management methods;

2. the adoption of state-wide guidelines for promoting efficiency; and

3. an investigation into the adoption of a weighting factor for special education transportation.

CHAPTER I

INTRODUCTION

More equitable funding of public school transportation is one of the essential objectives for the educational system of the state of Florida, if equal opportunity is to be provided for all children. Present allocations appear inadequate in light of the many roles school transportation has assumed. School desegregation, special education services, and an increased use in off-campus instruction have necessitated an expansion of public school transportation services, imposing an additional financial burden upon school districts.

School transportation has been with us since earliest times, when, "It was a familiar sight to see horses hitched to trees surrounding log schoolhouses in pioneer days" (Johns, 1928, p. 2). Early forms of school transportation were furnished privately; a family's horse and wagon were employed for conveying children to and from school.

Compulsory attendance laws indirectly served to highlight the need for some type of public financing of school transportation. Children, by state statute, were required

to attend school. This emphasis upon education as a priority, created the need for additional schools. One- and two-room schoolhouses were built in the countryside as well as in cities and towns, so that all children could attend school.

The inefficiency of this early system of education provided the impetus for the consolidation movement of the late 1800s (Bernd, Dickey & Jordan, 1976). Emphasis upon efficiency and quality education soon caused city school districts to join together in an effort to offer students better programs of study at a more reasonable cost (Bernd et al., 1976). Consolidation continued into the early twentieth century. "From 1917-1918 to 1921-1922, approximately 20,000 small schools were abandoned or made centralized schools" (Johns, 1928, p. 3). Transportation to and from consolidated schools became a public expense.

The need for some form of public financing of school transportation was first recognized by the state of Massachusetts. In 1869, Massachusetts passed a statute for the purpose of raising monies to support public transportation (Stollar, 1971). Other states also adopted statutes for transportation funds (Stollar, 1971).

Secondary education stressed the need for publicly financed school transportation. High schools were

comprehensive in nature, and usually served a geographic region, larger than a single township. Within a period of 30 years, from 1890 to 1920, the number of high schools increased by 1,800, with an enrollment increment of over 1.5 million students (Bernd et al., 1976).

After World War II, two different phenomena increased the number of students needing public school transportation. Suburbanization with its movement of people out of the cities and into neighborhoods located considerable distances from schools resulted in additional students being transported. Even in instances where schools were relatively close to students' homes, hazardous walking conditions, i.e., major thoroughfares, necessitated students being bused.

The Brown decision in 1954 paved the way for the second phenomenon, busing for desegregation purposes. Both black and white students were bused across school districts in an effort to end de jure segregation and to achieve racial balance within the nation's schools.

During the 1960s and 1970s, conveyance of school children for instructional purposes evolved in an effort to meet transportation demands of new and burgeoning school programs and activities. One such program, The Education for All Handicapped Children Act of 1975, frequently referred to as Public Law 94-142, was passed by Congress,

affording one million handicapped children, nationwide, access to a free public education and approximately four million handicapped children additional specialized services (Education for All Handicapped Children Act, 1976). Prior to 1976, less than one half the handicapped children in the United States received appropriate educational services, and at least one million were not enrolled in a public school program at all (Education for All Handicapped Children Act, 1976). The Fourth Annual Report to Congress on the Implementation of Public Law 94-142: The Education for All Handicapped Children Act (1982) summarizes the number of handicapped being served during the 1980-81 school year as compared to the number served during the 1976 school year:

> In school year 1980-1981, 4,189,478 handicapped children were provided services under P.L. 94-142 and P.L. 89-313. This number represents an increase of 153,259 children over school year 1979-1980 and an increase of 480,890 since the first child count in 1976. Thus, during the past year the number of children receiving special education services increased by four percent, and for the past five years the increase has been almost 13 percent. (p. 1)

This influx of handicapped children into the public school system has escalated education expenditures. During the 1980-81 school year, an estimated $10 billion was spent on special education services (Kakalik, 1981). A portion of these funds went towards providing special transportation services for handicapped children.

The cost of public school transportation has risen consistently over the past several decades. In 1930, total expenditure for public school transportation in the United States was $54,823,000 (Melcher, 1981). By 1979, total expenditures were $3.3 billion (Foster & Fields, 1982).

While the overall cost of public school transportation has escalated, individual state allocations to their school districts have not always kept pace. In Florida, during the past decade, state aid for public school transportation as a proportion of the total expenditures has steadily declined, even though legislative appropriations have increased. In the 1973-74 school year, state monies funded 61.6 percent of all public school transportation at a cost of $21,050,092; whereas during the 1980-81 school year, an allocation of $59,531,835 funded only 45 percent of total school transportation expenditures incurred (Foster & Fields, 1982). For that same year, percentages of state allocations to individual school districts ranged from 60.32 percent in Wakulla County to 30.15 percent in Hamilton County (Profiles of Florida School Districts, 1982).

With school transportation costs increasing, placing additional financial burdens upon school districts, it is important to ascertain how much the cost of special education

transportation contributes to the overall costs of public school transportation. Knowledge concerning special education transportation costs and the factors contributing to those costs might facilitate the development of better transportation programs and achieve equity among school districts.

Statement of the Problem

The problem of this study is to determine the most equitable method for distributing funds for the transportation of handicapped children to public schools.

Procedures

The study was conducted in three phases.

Phase I. In order to determine the most equitable method for distributing funds for the transportation of handicapped children, it was first necessary to identify factors which contribute to the cost of special education transportation. Therefore, a review of relevant literature was undertaken in two areas: (a) exceptional students and their related needs and (b) the general area of pupil transportation. The review of the literature included federal and state documents, statistical reports, dissertations, books and state studies.

In addition to these sources, a survey of the 50 states was conducted to determine how individual states currently

administer and finance special education transportation. A letter sent in March 1983 to state school finance directors sought the following information:

1. method used to finance exceptional student transportation,

2. calculations of formulae used,

3. Actual cost of state exceptional student transportation services,

4. types of exceptional students served, and

5. studies relating to the financing of exceptional student transportation services.

State directors who did not respond by the following fall were again contacted by telephone and letters.

Phase II. From the information gathered during Phase I, the factors contributing to the cost of special education transportation were determined. These factors were used to calculate the cost per exceptional student transported for the Florida school districts chosen as participants in the present study.

In order to determine the best model for funding special education transportation in Florida, two procedures were followed. First, the current pupil transportation formula was reevaluated to ascertain its effectiveness in funding both regular and special education transportation equitably

among school districts. Second, an alternative model was derived for possible utilization and as a point of comparison in weighing the merits of the current transportation formula.

The following two models were chosen for testing: (a) $y = ax + b$ and (b) $y = \frac{a}{x} + b$; y being cost per student transported, the dependent variable, and x being density, the independent variable. Multiple regression was the statiscal method used to add polynomial variables to the models.

Phase III. The two models developed during Phase II were tested with three different populations: (a) all students transported, (b) regular students transported, and (c) exceptional students transported. These populations were obtained from a stratified sampling of Florida school districts. The 67 Florida school districts were stratified according to 1982-83 district student population figures. School districts were placed in 1 of 12 categories ranging from "student population under 1,000" to "student population of 150,000 or over." From these categories, a stratified sample of 30 Florida school districts was formed. Both demographical and financial data were collected from the 30 school districts as well as the State Department of Education. After application of each model to all three

populations, correlation coefficients were calculated to determine what amount of cost per student transported could be explained by regular student transportation costs and exceptional student transportation costs. Final results were studied to determine what recommendations could be made concerning more equitable funding of exceptional student transportation in the state of Florida.

Delimitations

1. Any transportation funding formula developed by this study will be for the state of Florida and will not be designed with any of the other 49 states in mind.

2. Cost factors used in analyzing the effect of special education on overall cost of public school transportation will be gathered from Florida school district and Department of Education records. Cost factors may not be reflective of nationwide school transportation costs.

3. Of the 12 handicapping conditions defined by the Florida State Board Rules, 6 of these handicaps require no special transportation services: (a) educable mentally retarded, (b) speech impaired, (c) specific learning disabled, (d) gifted, (e) partially sighted, and (f) hard of hearing. Consequently, these six handicaps are excluded from any discussions concerning handicaps and special needs related to transportation.

Limitations

1. Although this study will identify specific variables related to the cost of special education transportation, it cannot be assumed that these are the only variables affecting special education transportation costs in all states. Any generalizations of these cost factors and any revisions in the funding formula must take into consideration variations existing among states.

2. Data on exceptional student transportation costs have never been collected by the state of Florida and, therefore, information was not available at the state level. Data for this study were obtained from local school districts. Due to variability in record-keeping procedures, there is a possibility that some error may exist in a particular district's expenditures on exceptional student transportation.

Justification of the Study

During February 1982, 707,390 students were transported to and from school in the state of Florida (Roberts, 1983). Of these students, 17,66 were handicapped students needing special transportation services (Roberts, 1983). The exact cost of special transportation services is unknown, as are the variables which contribute most significantly to this cost.

In an effort to delineate the costs involved in special education services, the Department of Education for the state of Florida conducted a study to analyze exceptional child transportation costs (Johns, 1977). The sample used included 15 Florida school districts. Both urban and rural regions of the state were represented (Johns, 1977). Variables considered as factors influencing special education transportation costs were route miles per day, daily cost for gasoline, operating costs, and number of students transported.

According to the study's findings, average annual cost per student for exceptional student transported ranged from $609.17 in Duval County to $77.72 in Volusia County (Johns, 1977). From the data available, "Route Miles per Day" appeared to be the variable most related to average annual cost per student. This finding correlates with the similar finding in regular pupil transportation that density is the most significant factor in predicting regular pupil transportation costs.

The study conducted in 1977 included only 15 of the 67 school districts in Florida. It did not consider the cost of salaries for bus drivers and aides. Since 1977, the population of handicapped students in Florida has increased considerably, with the category of "profoundly handicapped"

exhibiting the most growth. For these reasons a new study should be undertaken to determine what is the cost of special education transportation in representative districts in Florida, and which factors contribute to its cost. The identification of answers to these questions would aid state educators and budget officials in reviewing the method currently used by the state to fund all transportation--exceptional student transportation included--and revise, if necessary.

The current method used by Florida for funding public school transportation does not differentiate between handicapped and regular students. All students receive equal weighting, as opposed to some states, such as Kentucky where handicapped students are weighted five times greater than a regular student for the purpose of funding. The present formula used to determine the amount of state monies allocated to individual school districts for public school transportation is inadequate in view of escalating transportation costs.

In 1980-81, public school transportation costs for the state of Florida were estimated to be $131,531,830 (Roberts, 1983). Of this total cost, school districts contributed $72,162,460 or, roughly, 55 percent. State funds appropriated for transportation that year amounted to $49,369,375 (Roberts, 1983). This appropriation was

an increase of 7.34 percent over the previous year's legislative appropriation (Foster & Fields, 1982). However, the appropriation as a percent of the expenditures represents a decrease in state funding by 4 percent (Foster & Fields, 1982).

Since the 1973-74 school year, state appropriations for public school transportation have steadily declined, from 61.69 percent in 1973-74, to 45 percent in 1980-81 (Foster & Fields, 1982). The effect of this decline in state support is evident when individual district costs are analyzed.

For the 1981-82 school year, school districts received from the state allocations covering 31 percent to 60 percent of the total costs of public school transportation in their respective districts (Florida Department of Education, 1982). Forty-four of the 67 counties in Florida received from the state less than half the funds necessary for transportation costs (Florida Department of Education, 1982).

Such disparities support the belief that a reevaluation of the Florida funding formula for public school transportation is in order. For a new formula to generate a more equitable distribution of state monies, all factors which

influence the costs of public school transportation must be identified. Sparsity, topography, road conditions, and salaries of school bus drivers are variables which have been identified in previous studies as having varying impacts upon transportation costs (Bernd et al., 1976). The cost of transportation services for handicapped students is a factor whose effect upon overall public school transportation costs has not been thoroughly analyzed. The present study proposes to analyze transportation costs for handicapped students and develop funding models which could ensure more equitable dispersion of state funds for the transportation of exceptional students.

Definition of Terms

Deaf. A deaf student is one who has a hearing impairment which is so severe that the child is impaired in processing linguistic information through hearing, with or without amplification, which adversely affects educational performance (U.S. Office of Education, 1977).

Deaf-Blind. A deaf-blind student is one who has concomitant hearing and visual impairments, the combination of which causes such severe communication and other developmental and educational problems that they cannot be accommodated in special education programs solely for deaf or blind children (U.S. Office of Education, 1977).

Density formulas. A density formula is a method of funding by which state-recognized costs for each district reflect the average cost for districts with similar density.

Expenditure reimbursement formulae. An expenditure reimbursement formula is a formula based on actual costs incurred by a school district.

Handicapped/exceptional student. The term handicapped refers to those students evaluated and diagnosed as being mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, other health impaired, deaf-blind, multi-handicapped, or as having specific learning disabilities, who, because of those impairments, need special education and related services (Education for All Handicapped Children Act, 1976).

Hard of hearing. A hard of hearing impairment is a hearing impairment, whether permanent or fluctuating, which adversely affects a child's educational performance but which is not included under the definition of "deaf" in this section (U.S. Office of Education, 1977).

Linear density. Linear density is the number of pupils transported divided by the number of bus route miles.

Mentally retarded. Mental retardation is a significantly subaverage general intellectual functioning existing

concurrently with deficits in adaptive behavior and manifested during the developmental period, which adversely affects a child's educational performance (U.S. Office of Education, 1977).

Multi-handicapped. Multiple handicaps are concomitant impairments (such as mentally retarded-blind, mentally retarded-orthopedically impaired, etc.), the combination of which causes such severe educational problems that they cannot be accommodated in special education programs solely for one of the impairments. This term does not include deaf-blind children (U.S. Office of Education, 1977).

Net area density. Net area density refers to the number of pupils transported divided by the square mile area of a district served by school bus routes.

Orthopedically impaired/physically handicapped. A physical handicap is a severe orthopedic impairment which adversely affects a child's educational performance. The term includes impairments caused by congenital anomaly (e.g., clubfoot, absence of some member, etc.), impairments caused by disease (e.g., poliomyelitis, bone tuberculosis, etc.), and impairments from other causes (e.g., cerebral palsy, amputations, and fractures or burns which cause contractures) (U.S. Office of Education, 1977).

Other health impaired. Other health impaired students are ones who have limited strength, vitality or alertness,

due to chronic or acute health problems such as a heart condition, tuberculosis, rheumatic fever, nephritis, asthma, sickle cell anemia, hemophilia, epilepsy, lead poisoning, leukemia, or diabetes, which adversely affects a child's educational performance (U.S. Office of Education, 1977).

Seriously emotionally disturbed. The term means a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree, which adversely affects educational performance:

a. An inability to learn which cannot be explained by intellectual sensory, or health factors;

b. An inability to build or maintain satisfactory interpersonal relationships with peers and teachers;

c. Inappropriate types of behavior or feelings under normal circumstances;

d. A general pervasive mood of unhappiness or depression; or

e. A tendency to develop physical symptoms or fears associated with personal or school problems.

Visually handicapped. A visual impairment which, even with correction, adversely affects a child's educational performance. The term includes both partially seeing and blind children (U.S. Office of Education, 1977).

Organization of the Study

The proposed study is divided into six chapters. The first chapter introduces the problem and procedures to be used. Chapter II contains a review of the literature related to defining the needs of the handicapped students requiring special transportation. Chapter III contains a review of the literature related to pupil transportation and funding formulae developed by school finance theorists. Chapter III also contains a review of current methods used by the 50 states in funding special education transportation. In Chapter IV, efficiency formulae are reviewed with particular emphasis on the Florida efficiency formula. Statistical analyses are presented in Chapter V. Chapter VI presents the conclusions that can be drawn from the study, along with recommendations.

CHAPTER II

SPECIAL NEEDS OF EXCEPTIONAL STUDENTS

There is little research on the identification of factors affecting the cost of special education transportation. To provide a foundation for analyzing cost factors, a review of the literature was undertaken to present the evolvement and growth of special education services in the United States and to describe (a) individual handicaps and their related needs and (b) the impact certain handicapping conditions have upon the cost of school transportation.

Special Education Services: A Historical Perspective

In 1975 Congress passed the Education for All Handicapped Children Act (hereafter referred to as P.L. 94-142), granting handicapped children the right to a free appropriate education. Prior to the enactment of P.L. 94-142, educational services available to handicapped children varied in accordance with individual state legislation.

The Nineteenth Century

Historically, special education programs in the United States originated during the early nineteenth century when

isolated advocates of handicapped children established educational programs for specific handicaps or pressured state legislatures to pass legislation to achieve this outcome. The earliest known school for handicapped students was established in Hartford, Connecticut, in 1817. Thomas Hopkins Gallaudet founded the American Asylum for the Education of the Deaf and Dumb (now the American School for the Deaf) two years after returning from France, newly trained in the French method of manual communication for the deaf. Gallaudet brought with him a deaf teacher, Laurent Clerc, and together the two men traveled to various American cities soliciting money from private sources with which to establish their school (Moores, 1978).

The Connecticut legislature appropriated $5,000 for the school in 1816 and by April 15, 1817, it opened its doors to seven students. In 1819, the school's future was assured when the United States Federal Government turned over 23,000 acres of land to the school which the school in turn sold, accruing over $300,000. It was during this same year that other states began providing the tuition monies necessary to send deaf children from their states to The American School: Massachusetts in 1819; New Hampshire, 1821; Maine and Vermont, 1825; and Rhode Island, 1845 (Moores, 1978).

A second school for the deaf opened in New York in 1818. The New York Institution for the Education of the Deaf and Dumb first was funded by private donations and then in 1821, the State of New York appropriated funds to support the education of32 students (Moores, 1978). The New York school was the first day school for deaf students but soon evolved into a residential school program.

Pennsylvania was the site of the third school founded in this country for deaf students. Initially established in 1820 as a private school also, the state began supporting it in 1821 with funds to provide an education for 50 students. From 1823 to 1844, only three new schools were built for deaf students. Kentucky founded its state school in 1823, followed by Ohio in 1829, and Virginia in 1844. From 1844 to 1860, 17 new schools for deaf students were established. In 1864, the National Deaf Mute College was founded in Washington, D.C. The name later was changed to Gallaudet College in honor of the man who first began deaf education in the United States.

The need for educational services for other handicaps was not ignored. In 1830, due to the tireless efforts of Horace Mann, the Massachusetts State Legislature passed into law, "Resolve for Erecting a Lunatic Hospital" (Resolves of

the General Court of the Commonwealth of Massachusetts, 1828-1831), by which action the first state hospital for the mentally ill in the United States was founded in the city of Worcester, Massachusetts. Mann, best known in the annals of history for his unceasing labor to establish free compulsory public education for all children, also championed the rights of the handicapped.

Elected in 1827 by the town of Dedham, Massachusetts, to the Massachusetts State Legislature, Mann sought legislative support in abolishing the deplorable living conditions of the insane (Messerli, 1972). Forming a committee to study the plight of the insane, Mann toured poorhouses and gaols throughout Massachusetts, gathering evidence with which to goad the legislature into action. In 1830, Mann's bill was passed by both the House and the Senate.

Mann also was instrumental in securing legislative funds for the New England Institution for the Education of the Blind. Established in 1832, in Watertown, Massachusetts, under the directorship of Samuel Gridley Howe, the school was in need of research monies to develop teaching materials to be used with blind and deaf children. Upon visiting the school, Mann realized that Howe's research would ultimately lead to the implementation of specialized teaching techniques

and materials, the development of which was hampered by lack of funds. Mann, therefore, authored a memorial to the House of Representatives seeking permission to arrange for a visitation by the legislators to the school.

Other states were not idle in efforts to aid handicapped children. New York, in 1832, also established a school for blind students, and by 1852, New York, Pennsylvania, and Massachusetts all had appropriated money for programs for mentally retarded children (Kirk & Gallagher, 1983). Day programs for deaf students were started in Boston in 1869 and for mentally retarded students in Providence, Rhode Island, in 1896. Public school classes for physically handicapped and blind students were begun in Chicago in 1900. Consequently, by the early twentieth century, handicapped children had gained entry into the public schools in several states.

Severely handicapped students had a more difficult time conforming to the structure and expectations of public school systems. Schools were ill-equipped to handle students who exhibited aberrant characteristics. In 1893, a Massachusetts court ruled that student behavior resulting from "imbecility" was grounds for expulsion (Watson v. City of Cambridge, 157 Mass. 561, 32 N.E. 864, 1893), thereby barring many mentally retarded students from public schools. A

later court decision, State ex rel. Beattie v. Board of Education (172 N.W. 153, 169 Wis. 231, 1919) ruled that a handicapped student, although academically capable, be excluded from regular public school classes, because his handicap had "a depressing and nauseating effect on the teachers and school children" (p. 154).

This ruling prevented severely handicapped children, suffering from cerebral palsy or poliomyelitis, from attending regular public school day classes. Since special classes for these severely handicapped students had not yet been created in many cities, parents of such children had to resort to residential schools, private tutors, or forego education aspirations for their children.

The Twentieth Century

Despite these earlier judicial setbacks, social conditions of the twentieth century impacted favorably upon the growth of education services for the handicapped. The return home of disabled World War I veterans focused national attention upon the need for handicapped educational programs.

In 1918, The Soldiers' Rehabilitation Act was passed by Congress, followed in 1920 by the Smith-Bankhead Act (Kimbrough & Nunnery, 1976). Both pieces of legislation offered vocational rehabilitation services in the form

of job training and counseling. By 1944 these acts were amended to include services for mentally ill individuals and the mentally retarded, as well as providing additional funds for research and training programs (Kimbrough & Nunnery, 1976).

A second social condition significantly affecting handicapped children's quest for equal educational opportunity was the court-ordered desegregation of public schools. In Brown v. Board of Education (347 U.S. 483, 74 S.Ct. 686, 98 L.Ed. 873, 1954), Chief Justice Earl Warren noted,

> In these days it is doubtful that any child may reasonably be expected to succeed in life if he is denied the opportunities of an education. Such an opportunity, where the State has undertaken to provide it is a right which must be made available to all on equal terms.

While specifically referring to the rights of black children, Brown's legal mandate extended educational access to all children, including the handicapped.

In 1971, a federal district court ruled that retarded children in Pennsylvania were entitled to a free public school education (PARC, Bowman et al. v. Commonwealth of Pennsylvania, 343 F.Supp. 279 ED Pa., 1972). Furthermore, the ruling stipulated that whenever possible, retarded children must be educated in regular school classrooms rather than be segregated from the normal school population. Procedural

due process and periodic reevaluations of retarded children were also part of the consent agreement.

Mills v. Board of Education of the District of Columbia in 1972 (348 F.Supp. 866, D.D.C., 1972) expanded PARC to include all handicapped children. Mills emphasized appropriate educational placement of handicapped children.

Concomitant with handicapped litigation, federal legislation enacted during the 1960s and early 1970s advanced educational opportunities for handicapped students. Table 1 outlines the major pieces of legislation passed by Congress during this time.

P.L. 88-164 (1963) ordered construction of research facilities and community health centers for mentally retarded individuals. P.L. 89-10 (1965) authorized funds for the education of disadvantaged children. Title VI of P.L. 91-230 (1969) allocated funds to state educational agencies for meeting the needs of handicapped students. Title VI also established the Bureau of Education for the Handicapped and the National Advisory Committee on Handicapped Children. P.L. 93-380 (1973) appropriated federal monies for the education of handicapped students. Only states meeting specific provisions of the amendment were eligible to receive P.L. 93-380 funds (Cartwright, Cartwright, & Ward, 1981).

Table 1. Federal Legislation Passed During the Years 1963 to 1973

Legislation
1. Public Law 88-164, Mental Retardation Facilities and Community Mental Health Centers Act of 1963.
2. Public Law 89-10, Elementary and Secondary Education Act of 1965--Title VI.
3. Public Law 91-230, Elementary, Secondary, and Other Educational Amendments of 1969.
4. Public Law 93-380, Title VIB--Education of the Handicapped Amendment ("Mathias Amendment"), 1973.

State Statutes

State legislatures during this time were also active in passing legislation which mandated that handicapped children receive educational programs. By the time federal legislation had been enacted in 1975, many states already had state statutes requiring special education programs be offered in their state (Citron, 1982).

A few states had enacted laws in the early part of the twentieth century. Pennsylvania statutes governing the education of handicapped children date back to 1911. In one statute, duties of a special education administrator were clearly delineated:

> It shall be the duty of each supervisor of special education to examine and investigate the abilities, disabilities, and needs of the exceptional children in schools . . . . (P.L. 30, 1949, §1059)

Oklahoma and Connecticut each have state statutes mandating special education classes for handicapped students which were originally enacted in the early 1940s (O.S., 1949; General State Supplement, 1943).

State statutes did not always extend educational access to all handicapped children. New Jersey's statute mandating special education services provides an example of the limiting effect some state statutes had upon the scope of special education programs:

> It shall be the duty of each board of education to provide suitable facilities and programs of education for all children who are classified as handicapped under this chapter except those so mentally retarded as to be neither educable or trainable. (N.J.S., 1954)

In order to ensure that the rights of all handicapped children to an education be recognized, federal legislation became a necessity.

<u>Public Law 94-142</u>

In 1975 federal legislation in the form of the Education for All Handicapped Children Act was enacted. Incorporating many provisions of earlier litigation and legislation, P.L. 94-142 assured once and for all the right of all handicapped children to a public school education.

The need for P.L. 94-142 was expressed by Congress (1975):

> (1) there are more than eight million handicapped children in the United States today;
> (2) the special educational needs of such children are not being fully met;
> (3) more than half of the handicapped children in the United States do not receive appropriate educational services which would enable them to have full equality of opportunity;
> (4) one million of the handicapped children in the United States are excluded entirely from the public school system and will not go through the educational process with their peers;
> (5) there are many handicapped children

> throughout the United States participating in regular school programs whose handicaps prevent them from having a successful educational experience because their handicaps are undetected. (20 U.S.C. 1975, §§1400(b))

To ensure handicapped children basic educational rights, P.L. 94-142 incorporated certain tenets:

> (1) A free appropriate education, meaning, "special education and related services which (A) have been provided at public expense, under public supervision and direction, and without charge, (B) meet the standards of the State educational agency, (C) include an appropriate preschool, elementary, or secondary school education in the State involved, and (D) are provided in conformity with the individualized education program." (20 U.S.C. §1401 (18))
>
> (2) An individualized education program, meaning, "a written statement for each handicapped child developed in any meeting by a representative of the local educational agency or an intermediate educational unit who shall be qualified to provide, or supervise the provision of, specially designed instruction to meet the unique needs of handicapped children, the teacher, the parents or guardian of such child, and whenever appropriate, such child, which statement shall include (A) a statement of the present levels of educational performance of such child, (B) a statement of annual goals, including short-term instructional objectives, (C) a statement of the specific educational services to be provided to such child, and the extent to which such child will be able to participate in regular educational programs, (D) the projected date for initiation and anticipated duration of such services, and (E) appropriate objective criteria and evaluation procedures and schedules for determining, on at least an annual basis, whether instructional objectives are being achieved." (20 U.S.C. §1401 (19))

(3) Special education services meaning "specially designed instruction, at no cost to parents or guardians, to meet the unique needs of a handicapped child, including classroom instruction, instruction in physical education, home instruction and instruction in hospitals and institutions." (20 U.S.C. §1401 (16))

(4) Related services, meaning, "transportation, and such developmental, corrective, and other supportive services as may be required to assist a handicapped child to benefit from special education, and includes the early identification and assessment of handicapping conditions in children." (20 U.S.C. §1401 (17))

(5) Due process procedures which must be initiated with a written notice sent home to the parents describing the proposed placement of their child. The written notice must:

> (1) inform parents of available procedural safeguards; (2) describe and explain the action proposed or taken by the school; (3) state the options the school has considered and, if they are rejected, why; (4) describe each evaluation procedure, test record, or report the school uses to reach a decision; and (5) describe other factors included in making the decision. (Martin, 1979).

(6) A least restrictive environment (LEA) which mandates that "to the maximum extent possible, handicapped children be educated with nonhandicapped children. Martin (1979) defined LEA as meaning:

> Pupils must be placed in special or separate classes only when it is impossible to work out a satisfactory placement in a regular class with supplementary aids and services. State and local education agencies must ensure that a range of alternative placements is available to accommodate handicapped children in the least restrictive environment. (p. 17)

Congress authorized immediate implementation of all sections of the Education for All Handicapped Children Act on a priority basis: first, addressing the needs of handicapped children who were currently receiving no educational services at all; and second, upgrading the inadequately served needs of the most severely handicapped children. The Act further required that all handicapped children between the ages of three and eighteen receive an appropriate education by September 1, 1978; and by September 1, 1980, all handicapped children from age three to age twenty-one receive appropriate educational services (Martin, 1979). In setting these priorities, Congress neglected to appropriate adequate funding, placing a huge financial burden upon the states.

During the 1980-81 school year, 4,189,478 handicapped children were served, an increase of 153,259 children over school year 1979-80 (Fourth Annual Report to Congress on the Implementation of P.L. 94-142, 1982). From 1976 to 1981, the number of children receiving special education services rose 13 percent (Fourth Annual Report, 1982). During the three-year time span from 1978 to 1981, per pupil expenditures for handicapped students increased 37 percent, a substantial amount of these expenditures being financed by state budgets (Kakalik et al., 1981). Reflecting the

availability of special education services, the cost of these programs nationwide for the 1980-81 school year was $10 billion (Kakalik et al., 1981).

Handicaps and Related Needs

Handicapped children have been defined by the Education for All Handicapped Children Act (1976) as being "mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, or other health impaired children, or children with specific learning disabilities, who by reason thereof require special education and related services" (20 U.S.C. §1401 (1)).

The federal government has separated handicapping conditions into 11 categories: (a) deaf, (b) deaf-blind, (c) hard of hearing, (d) mentally retarded, (e) multi-handicapped, (f) orthopedically impaired, (g) other health impaired, (h) visually handicapped, (i) seriously emotionally disturbed, (j) specific learning disability, and (k) speech-impaired (U.S. Office of Education, 1977). For identification and placement purposes, state agencies have developed their own categories in accordance with P.L. 94-142 guidelines. In the state of Florida, the Florida State Board of Education has defined each exceptionality in terms of etiology and programming needs.

The Florida State Board Rules (Florida State Board of Education, 1982) identified 12 handicapping conditions requiring special education programs. Six of these disabilities require special transportation because of the gravity of the handicap: (a) trainable mentally retarded, (b) hearing impaired, (c) visually impaired, (d) physically impaired, (e) emotionally handicapped, and (f) profoundly handicapped. The next section of this chapter describes the six handicaps as defined by the Florida State Board Rules and identifies special transportation needs associated with each of the handicaps.

Mentally Retarded

State Board Rules (Florida State Board of Education, 1982) define a mentally retarded student as

> one who is significantly impaired in general intellectual functioning concurrent with deficits in adaptive behavior which are manifested during the developmental period. (6A-6.3011 (1))

Mentally retarded students in the state of Florida are classified according to the degree of severity in the loss of intellectual function and adaptive behavior. There are three classifications: (a) educable mentally retarded,

(b) trainable mentally retarded, and (c) profoundly mentally retarded. Educable mentally retarded students normally travel to and from school on regular district buses and do not require special transportation services. Profoundly retarded students and their needs are discussed in a later section, along with other profoundly handicapped groups. Trainable mentally retarded students and their related needs are discussed in the following section.

Trainable Mentally Retarded

Six to 10 percent of the mentally retarded population is classified as trainable mentally retarded (Cartwright et al., 1981). Along a continuum measuring severity of handicap (in this case lowered intelligence) from mild to profound, trainable mentally retarded individuals fall within the moderate range and generally possess IQ scores between 55 and 40 (Hallahan & Kauffman, 1982). Due to reduced intellectual functioning, trainable retarded students require adult supervision in most situations. As noted by Kirk (1979), "Complete self-sufficiency will be unlikely for most trainable retarded children" (p. 164). Results of a follow-up study conducted in the early seventies indicated that upon graduation from special classes, most trainable mentally retardates remained at home, unemployed and unable to attend rehabilitation programs due to lack of transportation (Stanfield, 1973).

In an effort to help trainable mentally retarded students become more independent and self-sufficient, school programs tend to emphasize personal and daily living skills, along with basic vocational training. One of the skills stressed usually at the secondary level is limited independence within the community. However, because of the lowered intelligence of trainable retarded students, such independence is difficult to achieve and situations involving ambulatory travel around the community can be dangerous.

A recent court ruling found two special education teachers negligent in the death of a secondary trainable mentally retarded student who had been hit by a car while in the teachers' care (Foster v. Houston General Insurance Co., 407 So.2d 759, 1981). The court, in passing judgment, declared, "the defendant teachers owed Foster [the student] a legal duty, the nature of which was determined by their relation to him, his mental retardation and the hazards to which he would be exposed on the walking trip" (p. 408). The student, 17 years old, had impulsively run out into oncoming traffic while walking along the street with his teachers and class.

A trainable mentally retarded student's need for increased supervision emphasizes the necessity for providing special transportation services. Reduced intellectual

functioning makes it impossible for trainable mentally retarded students to exercise the judgment required to travel by regular school bus to school. Special education transportation is necessary for transporting a trainable mentally retarded student from the student's home directly to school and vice versa.

Another reason for special education transportation services is the location of programs serving trainable retarded students. According to Kakalik et al. (1981), the majority of trainable mentally retarded students are educated in special day schools for the mentally retarded; 59.66 percent of all trainable retarded students attend special day schools. The next most predominant setting selected in teaching trainable mentally retarded students is a full-time special education class within a regular public school; 34.25 percent of the trainable retarded students attend such classes. Only a very small percentage of trainable mentally retarded students--5.29 percent--are mainstreamed into a regular class for part of the day. Of these students, 3.71 percent are secondary level students. Virtually no trainable mentally retarded students attend a regular class for most of their school day (Kakalik et al., 1981).

Consequently, even if trainable retarded students were able to be transported on regular school buses, location

of programs prevents this from occurring. Programs are usually centralized and often serve several school districts.

In summary, special transportation services for trainable retarded students is necessary for two reasons. First, the reduced intellectual level of these students precludes their traveling by regular school bus to school due to potentially dangerous situations while waiting at a bus stop and boarding and deboarding the bus without supervision. Second, most programs for trainable mentally retarded students are not located in the regular school building.

Hearing Impaired and Visually Impaired

Two other handicaps by reason of programmatic needs require special transportation services: (a) hearing impaired and (b) visually impaired. With both of these handicaps, the extent of the handicap determines their transportation needs.

State Board Rules (Florida State Board of Education, 1982) define a hearing impaired student as either one of two classifications: (a) deaf or (b) hard of hearing. Hard of hearing students in many cases function very well in the regular classroom, requiring only a few additional services, i.e., speech therapy. According to Kakalik et al. (1981), 43.39 percent of all hard of hearing children remain in regular classrooms, receiving itinerant teacher support

services. The second largest group of hard of hearing children are found in special classes with part-time attendance in regular classes; 24.10 percent of hard of hearing children are in this category (Kakalik et al., 1981). Approximately 9 percent attend full-time special education classes, while 8 percent attend regular classes with minimal related services. Special transportation services for these students is not warranted due to the less severe nature of their handicap. A second reason negating the necessity for special transportation is that hard of hearing students are most often educated in regular classes.

Deaf students, on the other hand, require the additional services offered through special education programs. Over half of all deaf students attend special education classes all day (Kakalik et al., 1981). Due to the relative infrequency of this handicap (estimated to occur in 1½ to 2 percent of the population), programs for deaf students are not housed in all neighborhood schools. Cost factors mandate that such programs be accessible to the whole population being served. Consequently, special education classes are held in centrally located school buildings and serve a large geographic area. As was the case with the trainable mentally retarded, in many states deaf students from one school district are bused to a program located in a neighboring school district.

Visually handicapped students' needs for special transportation match those of deaf students. The visually impaired comprise the smallest group of handicapped children; only .1 percent of all school-aged children have a visual disability (Ernst, 1977).

There are approximately 66,000 visually impaired children in the United States (Ernst, 1977). One-half of these children are considered blind. Blind students require a specialized curriculum which, along with academics, stresses mobility and independent living skills. Due to the small population served, programs for visually impaired students are centrally located, necessitating special transportation services for transporting students to and from the programs.

With both the hearing and visually impaired, the overriding reason for special transportation services is the location of program. A second reason for providing special transportation to these students is to avoid potentially dangerous situations hearing and visually impaired students might encounter due to their handicaps while traveling on regular buses.

Physically Impaired

State Board Rules (Florida State Board of Education, 1982) define a physically impaired student as

> one who has a physically disabling condition or other health impairment and such condition requires an adaptation to the student's school environment or curriculum. (6A-6.3015 (1))

The prevalence of physical handicaps in school-aged children has been difficult to determine due to newly discovered etiologies and the presence of accompanying handicaps. In 1975, the U.S. Office of Education estimated that .5 percent of all school-aged children were physically handicapped. Hallahan and Kauffman (1978) reported that "in 1975, it was calculated that there were 328,000 physically handicapped children in the United States, 28 percent of whom were receiving no special education services" (p. 380).

Only a small percentage of physically handicapped students are educated in regular classes--9.3 percent (Kakalik et al., 1981). Although many physically handicapped children are intellectually capable, the degree of impairment of their handicap may bar them from regular classrooms. Mobility restrictions, speech, and language problems, or the need for physical therapy, all contribute to limited access to regular classes. Sometimes special education classes for physically handicapped students are located in

a regular school building which permits some mainstreaming while still offering students resource special aid. However, Kakalik et al. (1981) reported that 49.41 percent of all orthopedically impaired students were homebound, while 13.89 percent were students at special day schools.

Physically handicapped students are provided special transportation services for two reasons. First, non-ambulatory students cannot travel on regular buses because of their wheelchairs. Buses specially adapted to hold wheelchairs are necessary, as well as extra features such as hydraulic lifts for placing the wheelchairs into the buses. Many physically handicapped students cannot ride regular schoolbuses because they are unable to support their bodies by themselves. Consequently, these students cannot sit in regular school bus seats because there are no restraints. Second, since the largest number of handicapped children outside of homebound are educated at special day schools, location of program necessitates special transportation service. The regular school is not the destination of the students, therefore, regular buses and routes cannot be used.

Emotionally Handicapped

State Board Rules (Florida State Board of Education, 1982) define an emotionally handicapped student as

> one who after receiving supportive educational assistance and counseling services available to all students, still exhibits persistent and consistent severe behavioral disabilities which consequently disrupt the student's own learning process. This is the student whose inability to achieve adequate academic progress or satisfactory interpersonal relationships cannot be attributed primarily to physical, sensory or intellectual deficits. The term does not include children who are socially maladjusted, unless it is determined that they are emotionally handicapped. (6A-6.3016 (1))

Emotionally handicapped students in the state of Florida are classified according to their ability to function within the least restrictive environment or most normal school environment possible. There are two classifications, the first of which, emotionally handicapped, is discussed below. The second classification, severely emotionally disturbed, is discussed in a later section of this chapter.

Estimates regarding the prevalence of emotional handicaps in children vary. The U.S. Office of Education in 1975 reported that 2 percent of all school-aged children suffer from some form of emotional disturbance. Other estimates have ranged from a high of 15 percent to a low of .05 percent (Schultz, Hirshoren, Manton, & Henderson, 1971).

Kakalik et al. (1981) found that the most frequently used educational setting for all emotionally handicapped children was the regular classroom, plus part-time special

class (46.20 percent). Special class plus part-time regular class was the second choice of educational placement, with 27.28 percent of all emotionally handicapped students educated in this arrangement. According to Kakalik et al. (1981), 9.49 percent of all emotionally handicapped students are educated in full-time special classes; 7.67 percent are educated in regular classes with the help of an itinerant special teacher.

In most cases, emotionally handicapped students who attend regular classes are able to be transported on regular school buses. Emotionally handicapped students educated in special education classes full time may require special transportation due to the location of the program and/or the degree of the emotional handicap which exhibits itself through aberrant behavior. Hostile, aggressive actions towards regular students, defiance of authority, or bizarre erratic behavior necessitate special transportation services and, in some cases, additional supervisory personnel.

Profoundly Handicapped

There are four categories of handicaps defined by the State Board Rules (Florida State Board of Education, 1982) as being profound: (a) profoundly mentally retarded, (b) deaf-blind, (c) autistic, and (d) severely emotionally

disturbed. All four of these handicaps are severely disabling conditions which consequently require specialized programs and special transportation. The Florida State Board of Education Rules (1982) define each of these handicaps:

> 1. profoundly mentally retarded--one who is profoundly impaired in intellectual and adaptive behavior and whose development reflects a reduced rate of learning. The measured intelligence of a profoundly retarded student generally falls below five (5) standard deviations below the mean and the assessed adaptive behavior falls below age and cultural expectations.
>
> 2. deaf-blind--one who has a hearing impairment and a visual impairment, the combination of which causes severe communication and other developmental and educational problems that cannot be properly accommodated in special programs solely for the hearing impaired or for the visually impaired student.
>
> 3. autistic--one who has a disability reflected in severe disorders of communication, behavior socialization and academic skills, and whose disability was evident in the early developmental stages of childhood. The autistic child appears to suffer primarily from a pervasive impairment of cognitive and perceptual functioning, the consequences of which are manifested by limited ability to understand, communicate, learn, and participate in social relationships.
>
> 4. severely emotionally disturbed--one who, after receiving supportive educational assistance and counseling services available to all students, still exhibits persistent and consistent severe behavioral disabilities which consequently disrupt the student's own learning process and who requires a special program for the full school week, and who requires extensive supportive services. (6A-6.301-6 (1))

Prevalence estimates for these handicaps are much smaller than those for other handicaps. Less than one tenth of one percent of the United States population is profoundly retarded (Haring and Smith, 1978). Haring and Smith (1978) described the profoundly retarded as having "a complex combination of most sensory and motor handicaps, with a high incidence of severe vision and hearing problems, cerebral palsy, and physical malformation" (p. 232).

Characteristics of profoundly retarded children include the following:

1. an estimated IQ of less than 20
2. minimal response level and few reflexes
3. inability to swallow or chew
4. no intelligible speech of self-help skills
5. nonambulatory
6. lacking the capacity to learn spontaneously by imitation. (Stainback, Stainback, & Maurer, 1976)

Deaf-blind students account for only a very small percentage of the deaf student population. According to Craig and Craig (1977), 21 percent of all deaf students are multi-handicapped; 8 percent of those students are deaf-blind. For the handicap of autism, the National Society for Autistic Children in 1979 placed the prevalence of autism as occurring in five out of 10,000 births, and being four times more common in boys than in girls. Finally, in the case of severe emotional disturbance, it has been estimated

that schizophrenia occurs in .02 to .06 percent of the student population. Severe emotional disturbance occurring in conjunction with other handicaps has a prevalence rate of one child in a thousand or .1 percent (Hallahan & Kauffman, 1982).

Over half the profoundly handicapped students are educated in special day schools administering to their specific needs, or live in/attend residential institutions (Kakalik et al., 1981). In Florida, deaf-blind students are served in programs located at the School for the Deaf and Blind in St. Augustine. Since the incidence of these handicaps is so low, residential programs are effective in providing good programs at a less prohibitive cost.

Profoundly mentally retarded and severely emotionally disturbed programs are offered at the district level and in many instances serve several districts. Autistic children are also served by these programs, which are provided at schools serving only these three types of children.

Special transportation services are mandatory for profoundly handicapped students. With the exception of possibly deaf-blind students, profoundly handicapped students are in many cases nonambulatory, out of touch with reality, and even dangerous to themselves. They require

constant care and supervision. Paraprofessionals often accompany these students on school buses to ensure their well-being.

The Impact of Specific Handicaps Upon the Cost of School Transportation

Special transportation of handicapped students is more expensive than regular, nonhandicapped student transportation. During the 1977-78 school year, transportation costs per pupil for a nonhandicapped student averaged $73, while the cost of transporting a handicapped student was $159 (Kakalik et al., 1981).

The cost for special transportation escalates as the educational placement of a handicapped student becomes more restrictive. For example, there are no special transportation costs incurred by learning disabled students because those students are educated in the regular classroom. In contrast, the average cost per pupil for special transportation for a mutiply handicapped student in 1977-78 was $980 (Kakalik et al., 1981). These students are typically found in special day schools or full-time special classes. Table 2 lists the transportation costs for the six handicaps discussed in this chapter, according to disability and placement. It can be seen that, generally, the more restrictive the educational environment, the more costly the transportation.

Table 2. Additional Transportation Costs Incurred According to Student Placement

Handicap	Placement		
	Regular Classroom	Full-time Special Class	Special Day School
TMR	$0	$324	$685
Emot.	$0	$467	$584
Deaf	$0	$554	$143
Blind	$0	$321	$685
Phys. Hand.	$272	$415	$323
Profound	$0	$561	$1271

NOTE: From J.J. Kakalik, W.S. Furry, M.A. Thomas, and M.F. Carney, The cost of special education (Santa Monica, California: The Rand Corporation, 1981).

Two factors which contribute to the need for a more restrictive environment and, consequently, special transportation are (1) severity of handicap and (2) location of program.

Severity of Handicap

Four of the six handicaps--trainable mentally retarded, severely emotionally disturbed, physically handicapped, and profoundly handicapped--involve such greatly diminished mental or physical capabilities as to warrant special educational services and alternate school transportation. Students who have been identified as trainable, severely, or profoundly mentally retarded do not possess the intellectual skills required for regular school transportation. Schloss and Sedlak (1982) observe that one "cannot assume that independent functioning, personal responsibility, and social responsibility develop adequately in the mentally retarded independent of special environmental influences" (p. 99). According to Schloss and Sedlak (1982), mentally retarded students are unable to

> interpret and respond to environmental influences in a way that will promote new learning. Limited learning diminishes the number of positive social responses that may be exhibited by the individual when faced with demanding situations. The results may be that the individual behaves inappropriately because of not being able to identify and/or utilize adaptive behaviors that others acquire without special learning experiences. (p. 100)

Mentally retarded students in the moderate to profound range are unable to pick up cues from the environment and respond accordingly; hence, the necessity for special classes and special transportation which assures safe delivery of the student from one caretaker to another.

Transportation and Adaptive Equipment

Physically handicapped, severely emotionally disturbed, and profoundly handicapped students by the nature of their disabilities, require extensive adaptive equipment not found on standard school buses. In order to accommodate these students, school districts must provide vehicles equipped with lifts or ramps, as well as restraints, handrails and additional maneuvering space. Vans or minibuses are viewed as the most acceptable vehicle for wheelchair use (Quick, Tell Me How, 1982; Dobberstein, 1980).

There are a variety of ramps and lifts on the market. In Florida, side-powered lifts are mandatory on school buses purchased for the transportation of physically handicapped students (Florida School Bus Specifications, 1982). Special service openings and doors are required to accommodate wheelchairs. In addition, modesty panels must be installed in front of all seats which do not have another seat at least eight inches in front of them (Florida School Bus

Specifications, 1982). In the interior of the bus, fastening devices are required for wheelchairs to prevent movement of the chair while in transit. Buses must also be equipped with passenger restraining devices in the event that they are needed.

In the transporting of most handicapped students, seatbelts and other personal restraining devices are necessary equipment (Quick, Tell Me How, 1982). For students who are under 40 pounds in body weight, car seats are a safe alternative to a wheelchair (Dobberstein, 1980). In the event that the child is too large for a car seat, but too small for a wheelchair, special chest harnesses can be attached to rings secured to the bus seats for this purpose.

With the severely or profoundly handicapped students, paraprofessionals are often employed to travel with the children to and from school. In a 1982 survey, Frith reported that 20 states currently use paraprofessionals in transporting handicapped students. Paraprofessionals (1) aid in maintaining appropriate behavior; (2) ensure all essential safety precautions are observed; and (3) are able to take immediate action in the event of a medical crisis.

A final piece of equipment advocated by Frith (1982) and Dobberstein (1980) is a two-way radio.

Location of Programs

The location of local district exceptional education programs often determines the type of transportation required for handicapped students. Prior to 1970, most handicapped children were educated in classrooms designated for their particular disability. With the passage of federal legislation in 1975, "a major change in programming was noted with the movement away from special classes for children with mild or moderate handicaps toward the integration of these children into regular classes" (Cambron, 1976, p. 14).

Kakalik et al. (1981) supported this statement in a 1981 study determining the cost of special education services. They reported that "all but 13 percent of the special education students spent at least part of the day in a regular program with nonhandicapped children" (p. 131).

However, the location of exceptional education programs within regular public schools does not negate the need for special transportation. Trainable mentally retarded, severely emotionally disturbed, physically handicapped, and profoundly handicapped still require special transportation, due to their disabilities. Hearing impaired and visually handicapped students who are able to travel on regular buses to school may require alternate transportation due to their disabilities because of either of two factors: sparsity

of students requiring a program or individual IEF program selection.

School districts, particularly sparsely populated rural communities, often lack the population of handicapped students necessary to fund an exceptional education program. One alternative for these districts is to transport handicapped students to adjacent school districts.

An example of this situation is Taylor County, Florida, where 21 handicapped students of various disabilities travel to programs in Tallahassee, Florida (W. Parker, personal communication, July 1983).

Selection of a particular program by an IEP committee also affects the transportation needs of exceptional children. The IEP process determines what type of placement is most suitable for each child. If the program selected is located out of the student's immediate neighborhood, special transportation will be necessary.

An example of this situation is the hearing impaired program in Duval County, Florida. There are two separate programs for hearing impaired students: the oral program located in the southeast section of the district and the total communication program located in the northwest section. Students living in the northwest section of the county, who attend the oral program in the southeast, require special

transportation, as do children who are in a similar situation with the total communication program (V. Smith, personal communication, July 1983).

In conclusion, two factors necessitating special transportation services are severity of handicap and location of program. A handicapped student who has a moderate, severe, or profound disability is unable to use the regular school bus due to diminished intellectual or physical capabilities. Special adaptive equipment, door-to-door delivery service, and additional professional aid all contribute to the escalation of transportation costs for exceptional students.

Location of programs for the handicapped also impacts upon the transportation costs for exceptional students. Handicapped students, who are mentally and physically capable of riding regular school buses, are forced to use special transportation because of a centralized location of their daily school program, or the utilization of interdistrict programs.

Summary

A review of the literature concerning exceptional students and their needs identified (a) the extent of the expansion of special education services since the early 1800s, (b) six handicaps needing special transportation, and (c) two

reasons for the necessity of special transportation services for these handicapped students.

Special education programs began in this country in the early nineteenth century, largely through the efforts of a few prominent men such as Thomas Gallaudet, Horace Mann, and Samuel Gridley Howe. Legislation during the twentieth century increased the number of educational programs available to most handicapped students. Both state statutes and federal legislation provided that school districts meet the educational needs of various handicapped students. However, severely and profoundly handicapped students often were excluded from public schools because of the gravity of their handicapping conditions. States also varied on the kind of services available to handicapped students. A federal standard defining the educational rights of handicapped students was needed to ensure that all handicapped students received necessary educational programs. In 1975, Public Law 94-142 or the Education for All Handicapped Children Act was passed by Congress, outlining states' responsibilities to the handicapped.

One million handicapped students gained access to the public schools. Many of the students were severely or profoundly handicapped. These students required special

transportation services to get to and from school for either of two reasons: (a) location of program or (b) extent of handicap.

Severity of handicap and location of program both cause the price of special transportation services to escalate; the further the student is removed from normal procedures or environments, the more expensive the transportation costs. Special transportation costs increase significantly when students are placed in full-time special education classes or attend special day schools.

Students attending these programs cannot travel on regular buses because of the location of their program or because of their inability to care for themselves while traveling to and from school. Handicaps involving the use of wheelchairs, restraints, and lifts to get in and out of vehicles also boost transportation costs. Adaptive equipment adds expense to the original cost of a bus and also necessitates using buses different from the ones used with regular students. Many times physically handicapped students are taught in regular classes but must travel in vans rather than the regular bus because of their handicap.

Profoundly handicapped students cannot properly take care of themselves even while traveling on special buses.

Aides are used in transporting the profoundly handicapped students to ensure their safety while traveling to and from school.

CHAPTER III

PUPIL TRANSPORTATION: REVIEW OF RELATED LITERATURE AND RESEARCH

Pupil transportation and methods for financing it must be studied in order to develop more efficient methods for funding special education transportation. For this reason, Chapter III is divided into three sections: (a) the history of school transportation in the United States, (b) a review of the original pupil transportation funding formulae, and (c) the presentation of current methods used to fund exceptional student transportation.

History of School Transportation

Public school transportation has been a part of the American school scene since earliest times. During the seventeenth and eighteenth centuries, school transportation was furnished by parents (Johns, 1928). Two educational movements occurring in the latter half of the nineteenth century served to shift the responsibility for pupil transportation from the parents to the local school district. The first of these, the enactment of state compulsory

attendance laws mandated that all children must be educated. This, in turn, "meant that public schools would have to be built within walking distance of pupils or transporation would have to be furnished" (Bernd, Dickey, & Jordan, 1976, p. 214). During the early stages of compulsory education, one-room schoolhouses were erected throughout the countryside, in an effort to educate rural children. However, it became apparent that it was not financially feasible nor educationally practical to build a school within walking distance of every child.

The second educational movement, consolidation, followed on the heels of compulsory attendance. Featherston and Culp (1965) cited two reasons for the consolidation movement:

> This was caused in part by the fact that the rural population . . . began to decline. It was owing even more to the fact that the school program was changing in character, so that offering in the small school the kind of education which most parents wanted for their children was no longer economically feasible. (p. 2)

During the early years of the twentieth century, 20,000 small schools were closed or converted into larger, centralized schools (Johns, 1928).

The growing acceptance of the importance of a high school education added to the momentum of the consolidation movement and pupil transportation. "A comprehensive

high school within walking distance of every student was a fiscal impossibility" (Bernd et al., 1976, p. 214). Therefore, the need to transport students from rural areas to large, comprehensive high schools existed.

Consolidation brought with it the need for pupil transportation furnished at public expense. Two reasons given by Johns (1928) for acceptance of local tax-supported pupil transportation programs were (1) "the good business sense of the American people," i.e., what many could do alone inefficiently, the community could do as a whole more efficiently, and (2) the faith of the American farmer that his children would be afforded the same educational opportunity as their wealthier urban counterparts.

In 1869 the first state law authorizing the use of local tax monies for public school transportation was passed in Massachusetts (Commonwealth of Massachusetts, Acts and Resolves, 1869). Other states soon followed, enacting their own statutes (Stollar, 1971). By the year 1900, 18 states had passed laws which allocated public funds for school transportation. Stollar (1971) reported that by 1920 "$14,514,544 was being spend to transport 356,401 pupils" (p. 333).

The invention of the automobile ushered in the motor age in America, having a resulting impact upon public school transportation. Twenty-mile bus routes, common in many states today, were impossible in the late nineteenth and early twentieth centuries (Featherston & Culp, 1965). The automobile had the effect of increasing "from 25 to 45 times the possible area that may be served by one school" (Stollar, 1971, p. 335).

The rapid growth of the automobile industry--during the 1920s, 17,292,838 motor vehicles were registered--necessitated better road surfaces (Featherston & Culp, 1965). Featherston and Culp (1965) reported that, "The U.S. Bureau of Public Roads estimates that of the approximately 2,000,000 miles of rural highways in use in 1890 only 100,000 miles had any kind of all-weather surface, which was gravel or crushed stone or less durable materials" (p. 4). Improved road conditions escalated the growth of school transportation programs. In 1922, there existed 387,000 miles of all-weather surface rural roads; during this year, 594,000 students were transported by local school districts. By 1960, the number of all-weather surface roads had risen to 2,557,000, and the number of students provided transportation stood at 12,700,989 (Featherston & Culp, 1965).

The increasing demand for pupil transportation prompted administrative interest in developing regulations and uniformity. "As states began to supply funds for pupil transportation, they began also to set various kinds of standards designed to improve the efficiency and economy of the service" (Featherston & Culp, 1965, p. 7). Minimum distances between school and a student's residence were set, so as to determine which pupils needed to be transported. Excessive mileage was decreased by more efficient routing of buses. Regulations governing maintenance and operations took effect.

National uniformity measures involving safety and school bus standards were recommended at a 1939 national conference, and revised and strengthened at subsequent conferences. Such safety measures and regulations are standard operating procedures today in all states. National uniformity in state traffic laws occurred with revisions of the Uniform Vehicle Code (Featherston & Culp, 1965). Prior to 1945, the Uniform Vehicle Code required that vehicles, when passing a school bus loading or unloading passengers, stop and then proceed past the bus at a speed of not more than 10 miles per hour (Featherston & Culp, 1965). In 1948, this provision was changed; vehicles now approaching a school bus discharging pupils must stop and remain stopped until the bus moves on.

In the latter decades of the twentieth century, public school transportation has taken on new dimensions. As one viable method for achieving racial desegregation in our nation's schools, intradistrict busing of both black and white students was augmented during the early 1970s. In the landmark decision Swann v. Charlotte-Mecklenburg Bd. of Education (402 U.S. 1, 91 S.Ct. 1267, 1971), Chief Justice Burger declared, "Desegregation plans cannot be limited to the walk-in school." This Supreme Court ruling gave birth to a new social phenomenon, "busing," by which the common public school bus became an effective tool against segregation. School buses have also been used to transport students to and from athletic events, as well as field trips and other scholastic events. Most recently, school buses have been adopted or special school buses have been ordered so that handicapped students can attend educational programs as mandated by federal legislation. The impact of this last role (the transporting of handicapped student) upon state formulas used in allocating monies to local school districts for pupil transportation programs will be addressed in the next section.

Pupil Transportation Formulae

Any research undertaken in the area of pupul transportation must first acknowledge the work of Mort and his

minimum foundation program. According to Johns (1928), Mort theorized "that all the taxpaying ability of the state should be equally burdened to provide a minimum educational offering for every child in the state" (p. 9). Towards this end, Mort (1924) proposed that any minimum foundation program developed by a state should include the following elements:

> 1. An educational offering found in all the communities in the state when the equalization program takes effect should be included in the minimum program.
>
> 2. When, because of conditions over which the local community has little or no control, supplementary undertakings are necessary in order to make it possible to carry on any activity, chosen under the first principle mentioned above, these undertakings should be included in the minimum program.
>
> 3. When additional offerings are required in order to supply educational returns commonly expected from the minimum program but which, because of conditions over which the local community has little or no control, may not be expected to materialize, these additional undertakings should be included in the minimum program.
>
> 4. If there is reason to believe that the inclusion of any element in a minimum program will have any other than a salutary effect upon the educational offering in any community or will bring about harm that is out of all proportion to the good involved in including it in the burden to be equalized, it should be omitted from the minimum foundation program. (p. 8)

Mort divided all costs of the state minimum foundation program into two groups: Group 1 being costs directly

related to the program, i.e., teacher salaries, classroom costs, and Group 2 being costs indirectly related to programming, such as transportation. Mort did not develop a method for equalizing transportation costs, but recognized the need for equalization in this area:

> There is need for the development of an adequate index for measuring the cost of transportation of pupils. In some communities transportation of pupils is necessary in order that the state's minimum program may be offered. The costs of such transportation are legitimate responsibilities of the state as a whole. . . . (p. 99)

Burns (1927), in a study undertaken to determine how best might the equalization of pupil transportation costs within an individual state be achieved, cited "distance from school" as a condition over which local communities had little or no control. Burns maintained that an index "which would enable a state to apportion school moneys for transportation in a manner consistent with the . . . principle . . . of equalization of educational opportunity" should be developed (p. 6).

Collecting data from New Jersey school districts, Burns constructed an index based upon two premises: (1) communities of geographic and demographic similarity should have similar pupil transportation costs and (2) factors measuring transportation needs and costs should not be within local control. Since transportation needs are based upon the

average distance between a student's home and school, and the number of students transported, Burns used the "percentage of pupils transported multiplied by the square root of square miles per building" (p. 19) as his measure of transportation need. This figure became the weighting factor that Burns incorporated into his index. Upon testing for association between this measure of need and density of school population, Burns found there to be a curvilinear relationship. When Burns took the log of the density, the relationship between the measurement of transportation need and density of school population became rectilinear.

Next, Burns formulated the regression equation $Y = be^{ax}$ as a method for determining the number of transportation need units to be assigned each county. The final step in Burns' study was to multiply each county's number of transportation need units by the state-wide average cost of transportation per student. The final figure from these calculations was the amount of state dollars an individual county received for transportation costs.

Johns (1928), in a transportation study encompassing five states, discovered two areas of Burns' work which needed revision: (1) the relationship between area per school building and cost was unknown and, therefore, should not be used as a weighting factor and (2) there were no administrative

safeguards for the controlling of the funds distributed to the school districts for pupil transportation.

Johns dealt with the first problem by devising a new way to measure transportation need. First, the relationship between the percentage of average daily attendance (ADA) transported and school population density was analyzed through regression analysis. Johns used the equation $Y = \frac{A}{(X+K)}$, Y being percentage of ADA transported, A and K being constants, and X being density. Johns discovered that a strong association existed between percentage of average daily attendance transported and school population density.

Next, Johns calculated the predicted cost per pupil transported, again by using regression analysis. The actual cost per pupil transported was the dependent variable; school population density was the independent variable. A strong relationship was found once again between school population density and the predicted variable, in this case, the predicted cost per pupil transported. The final step in Johns's calculations involved multiplying the number of students being transported by the predicted cost per pupil transported. The figure derived from this procedure was the cost of transportation for a particular school district.

Johns remedied the problem of no state administrative controls over the money being allocated to school districts

by setting up procedures to be followed when distributing aid. First, the minimum number of students to be transported by each county should be calculated by substituting the density figure in the formula and then multiplying the figure calculated by the average daily attendance of each county. The final figure represented the number of students allowable for receiving aid. If the number is less than the state limit, the school district should receive transportation funds for only that amount of students; if the number is greater than the state limit, then the school district receives transportation aid for only the minimum. By utilizing this procedure, school districts would become more efficient in the administering of transportation programs.

Several other methods for financing pupil transportation were developed during the 1930s and 1940s. Evans (1930) proposed the use of bus route length and seating capacity for predicting transportation costs in the state of California. Using multiple regression analysis, Evans developed a predicted costs table based upon these two variables. Evans maintained that the use of density, advocated by earlier researchers, was unreliable in predicting transportation costs in California, because of large tracts of uninhabited areas.

Reusser (1932) agreed with Evans, finding little relationship between density and transportation costs in Wyoming because of the vast areas of the state which were unpopulated. Instead, Reusser used the variables, route length, and number of students in calculating transportation costs. Reusser multiplied the number of pupils by route length which resulted in a pupil-mile measure. Cost per route based upon the pupil-mile measure were then determined by regression equation. The sum of all predicted costs for all routes was used to determine state allocations.

Lambert (1938) also disputed the findings of Burns and Johns on the importance of the density factor as the main variable used to predict pupil transportation costs. He proposed that nine other factors affected the amount of transportation needed by a particular district:

1. school organization factor,

2. limits set by the district for reasonable maximum walking distances,

3. the number of students in a district who live beyond the reasonable maximum walking distances,

4. the time factor involved in transporting students to school and the earliest hour of pickup,

5. road conditions,

6. the total seating capacity of vehicles used,
7. the average speed of the vehicles,
8. the density of population, and
9. natural boundaries and district boundaries.

Lambert maintained that these factors should be reflected in the calculating of a district's transportation costs. In order to include these variables, Lambert proposed that a comprehensive budget model should be used to determine district transportation costs. Unit costs developed by the state then would be applied in calculating the funding allotment for each particular district.

Another method for funding pupil transportation costs was advanced by Hutchins and Holy (1938). These researchers, conducting a transportation study in Ohio, maintained that several variables should be used in predicting costs rather than just one or two. Hutchins and Holy found three factors which contributed to the cost of transportation: (a) density, (b) number of pupils transported, and (c) road conditions. Using regression analysis, the researchers found that the three factors resulted in a .66 correlation between predicted costs and actual costs.

In 1941, Mort and Reusser utilized the earlier cost per route method advanced by Evans in funding school transportation in New Jersey and Maine. In calculating the costs for

Maine, the variable, road conditions, was added to the model. Using separate equations, costs were predicted on the basis of paved or unpaved roads.

From the period of the late 1940s to the early 1970s, little research was conducted on pupil transportation costs. During the 1970s, the National Education Finance Project (NEFP) conducted transportation studies in numerous states. Researchers from NEFP assessed ongoing methods used for administering a state pupil transportation program and recommended changes when necessary (Melcher, 1979).

In 1973, two studies were conducted by the NEFP. In Kentucky the state pupil transportation system was analyzed and changes were recommended in the method used to compute the cost per pupil and the density of pupils per square mile was recommended to be used in determining the state-approved cost per pupil transported (Farley, Alexander, & Bowen, 1973). A regression equation $Y = ax^b$, where Y was cost per pupil transported and x was density, was advocated for computing this cost. Farley et al. defined density of pupils per square mile as "the number of pupils transported divided by the square mile area of the district served by school bus routes" (p. 250). The researchers also recommended that along with the basic state allocation given for transportation, supplementary funds should be allotted for the

transportation of special education students. These funds should be "double the formula adjusted cost and be in addition to that received in the regular transportation allotment" (p. 280).

In a South Dakota study, Frohreich (1973) offered several recommendations for revising state financing of the pupil transportation program. Frohreich suggested that statewide criteria should be established regarding bus routes, and reimbursable costs should be identified. Frohreich also suggested that the relationship between cost per pupil transported and density per linear mile should be calculated by using the regression equation $Y = aX^b$. By this method, state allocations for pupil transportation could be distributed more equitably to local school districts. As in the Kentucky study, the financing of handicapped students was taken into consideration. Frohreich advocated a 5.0 weighting factor for the transportation of handicapped students who could not be transported on regular school buses.

Supplementary allocations for the transportation of handicapped students again surfaced as a recommendation in an Indiana study conducted by Jordan and Alexander (1975). Like Frohreich in South Dakota, Jordan and Alexander advocated that the state should use a 5.0 weighting factor for

severely handicapped children. Need for such a weighting factor was evidenced by the increased costs involved in transporting handicapped students in terms of (1) special buses and equipment, (2) increased mileage per student, and (3) additional salaries for aides and other personnel.

Jordan and Alexander also advocated that the state adopt a cost/density formula in determining allocations to school districts. The formula could be calculated using either linear or area density. In Indiana's case, Jordan and Alexander recommended using linear density because the necessary data required to use area density was unknown. In addition, busing for desegregation purposes was a future reality, which would negate the effectiveness of area density.

Two further recommendations suggested by Jordan and Alexander were that the calculation of depreciation costs should be part of the state transportation program, and the reasonable walking distance standard should be reevaluated in accordance with current hazardous walking conditions.

In 1975, the efficacy of utilizing area of linear density in pupil transportation formulae was questioned (Bernd, 1975). Based upon research conducted by Bernd in the state of Colorado, linear and area density failed to

correlate highly with various transportation expenditures. The highest correlation attained by either density variable was an _r_ of .60 between area density of ADAE (average daily attendance entitlement) and salary expenditure per mile. In contrast, "strong correlations of .90 or better between number of students transported and total expenditures, operating expenditures, salary expenditures and other expense expenditures were noted" (p. 84).

Bernd also disputed the premise that any relationship existing between density and cost is nonlinear and, therefore, not adequately depicted by the Pearson correlation. Investigating this possibility by use of a scattergram, Bernd concluded that the dispersion of plotted points merely pointed out a low relationship between density and transportation expenditures, rather than curvilinearity. Based upon the above research findings, Bernd recommended that the state of Colorado adopt a "Pupil Mile Plan" transportation funding program dependent upon a line of best fit between cost per pupil transported and miles per pupil.

A later study conducted in Colorado (Gallay & Grady, 1978) found that linear density accounted for 84 percent of the variation in cost per pupil transported when both variables were expressed in logarithm form. Using 17 independent variables to predict cost per mile and cost per

pupil transported, Gallay and Grady found that linear density, highway density, and average teacher salary accounted for 70 percent of the variation in cost per mile. The researchers concluded that linear density was appropriate for use in predicting the cost per pupil transported for districts.

A density/cost formula was again recommended for use by Alexander in a 1977 West Virginia transportation study. Using stepwise multiple regression equations, the relationship between cost per pupil transported and 13 independent factors was analyzed. Linear density was entered first in the equation, accounting for 62.8 percent of the variance in cost among counties. When percentage of paved road mileage was entered next, the amount of variance accounted for by these two variables rose to 66.3 percent.

Citing previous studies indicating that the relationship between cost and density is curvilinear rather than linear, Alexander computed a curve of best fit between cost and density as expressed by the equation $Y = aX^b$. The R^2 for this equation was .657. "Since the curve of best fit using density alone as the independent variable explains nearly as great a proportion of the variance in cost as the straight line formula using both density and road conditions" (p. 184), Alexander concluded that this latter

method should be the basis for determining pupil transportation allocations in West Virginia.

One year later, in the state of Arkansas, Alexander and Hale (1978) advocated modifications in the state cost/density formula, thereby ensuring more equitable allocation of state funding of pupil transportation. First, the researchers proposed that density/allocation charts be revised annually to reflect fluctuations in costs incurred by districts. They then recommended that the state fund 80 percent of the predicted current transportation costs, based upon a curve of best fit between area density and ADT. In conjunction with this modification, Alexander and Hale proposed that state officials consider strengthening the formula by deleting square miles not served, or changing to linear density for a more accurate tabulation of miles traveled.

The second modification proposed by Alexander and Hale concerned the distribution of capital outlay funds. Instead of allocating a flat amount for each unit, the researchers recommended unit aid be computed as "8 percent of the current estimated replacement cost of approved units based upon a ten-year useful life and an 80 percent state funding level" (p. 152).

A third modification recommended by Alexander and Hale involved minimum and maximum aid standards set by the state.

The researchers recommended that these limits be 50 percent (minimum) and 120 percent (maximum) of the adjusted cost, rather than the current monetary limits per unit of $3,800 and $5,300.

Alexander and Hale further advocated that the Arkansas State Department of Education "study the excess costs associated with the transportation of handicapped pupils to determine whether an adjustment should be made to reimburse districts for the excess costs associated with this type of service" (p. 152).

Recommendations to alter the existing transportation formula of Indiana were proposed by Stollar and Tanner (1978). The fomula was based upon linear density. Stollar and Tanner suggested that the formula be modified to reflect annual cost-density relationships and to correct for inflation. The researchers also advocated that depreciation aid be provided by the state for district-owned school buses and adjustments be made for local wealth variations "when aid reductions are necessary to match entitlements with appropriations" (Melcher, 1979, p. 222).

A third study conducted during 1978 in New York State incorporated three variables to predict district pupil transportation costs: (a) area density, (b) number of pupils

transported, and (c) number of schools involved in the transportation of students (Hennigan, Furno, & Gaughan, 1978). According to Melcher (1979), these researchers developed a two-tier aid ratio formula. The first tier reimbursed districts for 95 percent of the cost per pupil transported, or 95 percent of $90, depending upon which amount was less. The second tier of the formula determined aid by subtracting $90 from the actual cost per pupil transported. This figure was then multiplied by 1-(.4 district wealth divided by state wealth). An additional adjustment in the formula was the use of weighting for different kinds of students. Regular students were given a weighting factor of 2.0; while special education students received a factor of 6.0.

A final study conducted in the state of Illinois in 1978 affected the development of a formula based upon area density, linear density, mode of operation, and district type (McKeown). The formula incorporated the use of 26 dummy variables and resulted in explaining 56 percent of the cost of pupil transportation. The formula also used weighting factors for special education and vocational students. A weighting of 4.294 was applied to special education students; vocational students received a weighting of 1.347.

Current Funding Methods Used with Exceptional Student Transportation

Current methods of funding exceptional student transportation reflect earlier research findings of pupil transportation studies. In March, 1983, a survey of the 50 states was undertaken as part of this present study in order to determine how exceptional student transportation is managed and financed in the individual states.

Five different types of information were sought from state school finance directors:

1. method used to finance exceptional student transportation,
2. formulae used for the calculations,
3. actual cost of state exceptional student transportation services,
4. types of exceptional students served, and
5. studies relating to the financing of exceptional student transportation services.

The information request sheet utilized by the survey is presented in Appendix A.

Out of the 50 states, 6 states did not respond. These were (a) Alabama, (b) Colorado, (c) Connecticut, (d) Massachusetts, (3) Minnesota, and (f) West Virginia. School

finance directors for the states of Oregon and New Hampshire replied but were unable to supply the necessary information. Oregon sent rules concerning the transportation of exceptional students, but no information on actual costs or how the transportation was funded. The New Hampshire state school finance director replied that there was no state financing of transportation because no appropriations were made available from the legislature.

Method Used by State to Finance Exceptional Student Transportation

A variety of methods are used by the states to finance exceptional student transportation. Table 3 outlines the methods currently in use for allocating monies for exceptional student transportation. For a more detailed description of state funding of special education transportation, please see Appendix B. Reimbursement for district exceptional student transportation ranged from 100 percent reimbursement (Maine, Alaska, Wyoming) to no state aid at all (New Hampshire and Vermont).

Approximately half of the states reimbursed districts for at least 50 percent of the cost per exceptional student transported. Amounts varied from 90 percent in New York

Table 3. Methods Used by 50 States to Allocate Funds for Special Education Transportation

State	Block grants/ foundations	Density formulae	Reimbursement
	Method Used for Allocation		
Alabama[a]			
Alaska			X
Arizona	X		
Arkansas		X	
California			X
Colorado[a]			
Connecticut[a]			
Delaware			X
Florida		X	
Georgia			X
Hawaii[b]			
Idaho			X
Illinois			X
Indiana		X	
Iowa	X		
Kansas			X
Kentucky		X	
Louisiana			X

Table 3 (continued)

State	Method Used for Allocation		
	Block grants/ foundations	Density formulae	Reimbursement
Maine			X
Maryland	X		
Massachusetts[a]			
Michigan			X
Minnesota[a]			
Mississippi	X		
Missouri		X	
Montana			X
Nebraska			X
Nevada	X		
New Hampshire[c]			
New Jersey		X	
New Mexico			X
New York			X
North Carolina		X	
North Dakota			X
Ohio			X
Oklahoma		X	
Oregon[a]			

Table 3 (continued)

	Method Used for Allocation		
State	Block grants/ foundations	Density formulae	Reimbursement
Pennsylvania			X
Rhode Island			X
South Carolina[d]			
South Dakota			X
Tennessee	X		
Texas			X
Utah		X	
Vermont[c]			
Virginia		X	
Washington			X
West Virginia[a]			
Wisconsin			X
Wyoming			X

[a]No information supplied by states.
[b]By state appropriation--funds are provided according to bids.
[c]No state support for transportation.
[d]School buses owned and operated by state.

State to 50 percent in South Dakota. Most states providing reimbursement listed allowable costs and permitted partial or total reimbursement of the costs. Several states, such as Idaho, Michigan, and New Jersey, authorized a certain percentage of the total cost for exceptional student transportation to be reimbursed, while other states stipulated certain items as being allowable costs and based reimbursement by percentage on the sum of the allowable costs.

Block Grants and Foundation Programs

Four states included their transportation programs within the overall educational finance plan: (a) Arizona, (b) Iowa, (c) Maryland, and (d) Nevada. With these states, exceptional student transportation was treated no differently than regular transportation (Arizona) or exceptional student transportation costs were included under handicapped program costs. In this latter case, transportation costs were considered a part of the total programming costs and not an isolated entity. Three states fund transportation costs of exceptional students from special education monies rather than transportation division funding. Nebraska, North

Dakota, and Tennessee all are reimbursed for exceptional student transportation by their handicapped education divisions.

Nebraska also transports most of the exceptional students in the state by private vehicle. Parents are paid 18¢ per mile to drive students to schools. This method is used because of the sparsity of students in many areas of the state. District owned school buses are used only in Omaha and Lincoln, the two most populated areas of the state.

Density Formulae

Seven states utilize density formulae in funding pupil transportation costs. Florida does not differentiate between regular students and exceptional students. Kentucky increases the reimbursement for exceptional students by assigning a weighting factor of 5.0. Arkansas also increases the basic cost per student transported allocation by three additional factors: (a) $300 for each bus transporting handicapped students, (b) $200 additional if the bus has a lift, and (c) $25 for each handicapped student. Indiana and Missouri both increase reimbursements to districts for exceptional student transportation by funding 80 percent of additional costs incurred in transporting exceptional students.

Unique Reimbursement Plans

Hawaii and South Carolina have financing plans sufficiently different from other states so as to be judged unique. Hawaii is the only state in the union which practices full state funding. This is due to the fact that Hawaii has no local school districts. Therefore, transportation is contracted to private businesses; the lowest bid being awarded the transportation contract.

A different case exists in South Carolina. The State Board of Education owns and operates all school buses. Maintenance and operational costs are paid for by the state board. Costs incurred by the local districts in supervising the routing and organizing of students needing transportation are reimbursed by funds appropriated by the legislature.

Cost of Exceptional Student Transportation

The cost of exceptional student transportation varied tremendously, with the more populous states accruing much larger costs. New York led the states in the amount of money spent on exceptional student transportation, reporting a figure of $170,200,000. California was second highest with $107,000,000 spent on exceptional student services during the 1982-83 school year. (See Table 4.)

Table 4. Total State Expenditures for Exceptional Student Transportation Services in the 50 States

State	Cost
Alabama	N.A.
Alaska	$ 2,252,442
Arizona	10:1 ratio with regular costs
Arkansas	N.A.
California	$107,000,000
Colorado	N.A.
Connecticut	N.A.
Delaware	$ 3,416,400
Florida	N.A.
Georgia	$ 10,603,538
Hawaii	$ 3,715,470
Idaho	N.A.
Illinois	$ 64,315,412.42
Indiana	$ 5,045,018
Iowa	N.A.
Kansas	$ 9,700,872
Kentucky	$ 7,600,000
Louisiana	$ 857,685
Maine	N.A.
Maryland	N.A.

Table 4 (continued)

State	Cost
Massachusetts	N.A.
Michigan	$ 55,015,705
Minnesota	N.A.
Mississippi	$ 1,000,000
Missouri	$ 10,265,849.28
Montana	$ 745,605
Nebraska	$ 5,842,110
Nevada	N.A.
New Hampshire	$ 1,894,605
New Jersey	$ 40,000,000
New Mexico	N.A.
New York	$170,200,000
North Carolina	$ 10,981,578
North Dakota	N.A.
Ohio	N.A.
Oklahoma	N.A.
Oregon	N.A.
Pennsylvania	$ 40,000,000
Rhode Island	$ 5,724,076

Table 4 (continued)

State	Cost
South Carolina	$ 4,693,447
South Dakota	$ 1,050,729
Tennessee	$ 4,560,241.28
Texas	$ 22,022,337
Utah	$ 18,975,000
Vermont	$ 1,166,863
Virginia	N.A.
Washington	N.A.
West Virginia	N.A.
Wisconsin	$ 14,387,479
Wyoming	N.A.

On the other end of the extreme, Montana reported the lowest expenditure figure for exceptional student transportation, $745,605. Louisiana was second lowest with a figure of $857,685. Twenty-one states either failed to report or were not able to report the cost of exceptional student services in their state. Several school finance directors in answering the survey stated that the cost of exceptional student transportation was unknown. This occurred with states in which no distinction was made at the district level between regular and exceptional students in funding transportation costs.

Types of Handicapped Students Transported

There was a general agreement among the states concerning the types of students transported. Seven states did not have a breakdown of the students transported and, therefore, maintained that they could not answer the question. However, the rest of the states reported similar handicaps served by special transportation. These categories are the (a) physically handicapped, (b) severely/profoundly handicapped, (c) trainable retarded, and (d) emotionally disturbed.

Programming needs also necessitated the transporting of deaf, hard of hearing, and visually handicapped students

by special buses. California reported that "nonseverely handicapped" students also were transported by special buses, if necessary. By this it was taken to mean emotionally disturbed, deaf, or visually handicapped, or perhaps educable retarded students.

Students reported as not requiring special transportation services were educable mentally retarded, learning disabled, and socially maladjusted.

Summary

A review of the literature regarding pupil transportation has shown that school transportation has grown from parent-provided modes of travel, prevalent during the seventeenth and eighteenth centuries, to state-supported programs of the twentieth century. With the growth of state-supported programs, school finance researchers developed methods for funding district transportation programs which would be equitable as well as efficient. Burns and Johns developed models for financing school transportation which incorporated the use of a density index, which they discovered had a curvilinear relationship with transportation need.

Later researchers developed alternative methods for financing pupil transportation based upon route length and bus capacity; a full budget model in which all costs attributed to transportation were considered; and the use of

several variables to predict transportation costs, rather than only density.

During the 1970s the National Educational Finance Project conducted studies in several states advocating the use of density in predicting transportation costs. Weighting factors for the transportation of exceptional students were also proposed in Kentucky and Indiana of 5.0.

McKeown, in a 1978 study conducted in Illinois, also advocated the use of weighting factors for exceptional student transportation and vocational transportation. The factors suggested by McKeown were 4.294 for exceptional students and 1.347 for vocational students.

In a survey completed in November of 1983, findings indicated that methods employed by the 50 states for funding exceptional student transportation are varied and uneven in funding. Several states reimburse local districts at 100 percent of their costs, while two states do not reimburse transportation at all. New York, with an expenditure figure of $170,200,000, spends the most for exceptional student transportation; Montana, with a figure of $745,605, spends the least. Florida, whose total expenditure for exceptional student transportation is unknown, makes no distinction between regular and exceptional students. Florida school

transportation officials maintain that the present formula provides for both student populations because of the use of the density index. In Chapter IV of this study, alternate funding models will be developed to ascertain the accuracy of this claim.

CHAPTER IV

DEVELOPMENT OF ALTERNATIVE PUPIL TRANSPORTATION MODELS

Introduction

To provide an understanding of the formula used for pupil transportation in the state of Florida and alternatives to be developed, an explanation of efficiency in education, generally, and in pupil transportation, specifically, is helpful. In this chapter, an examination of the Florida pupil transportation formula, in relation to the funding of exceptional student transportation, and the development of an alternative model are prefaced by a discussion of the concept of efficiency and its impact upon state educational fiscal policies.

Educational Efficiency

Popularized by educational traditionalists during the early twentieth century, efficiency, a term borrowed from industry, quickly became the prevailing concept of the era. Scientific management, in the form of bureaucratic departmentalism was introduced by Weber and expanded by Gulick (Kimbrough & Nunnery, 1976). In theory, efficiency--the

attainment of objectives without increases in human and financial resources--was a laudatory goal; in practice, the espousal of business management techniques without sufficient forethought spawned deleterious consequences (Callahan, 1962). By 1930, wholesale adoption of scientific management was on the wane; a new emphasis upon human relations and the behavior sciences prevailed.

During the 1970s, the concept of efficiency once again surfaced as a viable means for revamping educational organizations. Thomas (1971) discussed the importance of efficiency through systems theory. He observed that educational systems consist of inputs: (a) people, (b) buildings, (c) books, and (d) equipment. These are designed to produce certain outputs, which are the prescribed educational skills in students. The relationship between inputs and outputs was depicted by Thomas in his production function equation: $O_i = g(I_1, I_2, \ldots I_n)$. Efficient educational organizations are those in which there exists a favorable balance of outputs to inputs.

In determining which inputs should be maximized in effecting desired outputs, an analysis of the costs of education must be undertaken. Thomas included three types of costs in his analysis: (a) direct and indirect costs, (b) social and private costs, and (c) monetary and

nonmonetary costs. Direct costs are those normally considered to be the costs of education--the hiring of staff, building maintenance, and the purchasing of equipment. Indirect costs include depreciation of buildings, interest on capital and all foregone earnings of students.

The second category in Thomas' analysis assigned costs to either the public or private sector. Private costs are borne by parents in the form of foregone opportunities for investment. Public costs are accrued through taxes expended upon education. Social costs are composed of private and public costs, the sum of which society contributes as a whole towards education. Total costs of education can then be compared with the social benefits accumulated by a nation in providing education.

Monetary and nonmonetary costs can be incurred by society or an individual. Nonmonetary costs for the individual include the loss of alternatives such as leisure time. Societal nonmonetary costs include the perceived disturbance of community members living adjacent to school grounds. Nonmonetary costs within schools take the form of lost opportunities in choice of study; if a student chooses one course of study, that choice automatically precludes a variety of of the choices.

After a study has been conducted to determine the underlying costs of all inputs, school administrators can utilize one of several decision-making models to determine the most efficient input/output relationship for implementation (Thomas, 1971). Three models advocated by Thomas are the input-output, cost-effectiveness, and cost-benefit models. Each of the three models emphasizes an examination of all viable alternatives and associated costs. Efficiency is achieved when there is "a clarification of goals, and identification of relevant resources, and a rational approach for selecting the best means to attain given ends" (Thomas, 1980, p. 149). Along similar lines, Rawls (1971) proposed that an educational system is efficient when reallocation of resources would result in one input producing less than another; and reallocation of benefits would result in one recipient accruing more benefits than another.

In relating efficiency specifically to the area of school finance, Thomas (1980) maintained that there are three criteria inherent to any state school finance system: equality, efficiency, and freedom of choice. The criteria are reciprocal in that one cannot be manipulated without affecting the other two. Thomas defined efficiency as utilizing procedures which "increase goal attainment with

no increase in cost, reduce cost without reducing goal attainment, or enhance goal attainment while also reducing costs" (p. 148).

Historically, researchers in school finance have endeavored to develop models which, while efficient, did not sacrifice interdistrict equity and local educational choices. Cubberley (1906), in his seminal study on school finance in the United States, reported that many school districts were saddled with excessive financial burdens due to the enforcement of minimal education standards and existing inequal distributions of wealth. Cubberley recommended that state school finance plans be aimed at eradicating unjust policies.

Subsequent financial theorists attempted to incorporate both efficiency and equalization into their models. Updegraff (1922) proposed that "the efficient participation of citizens . . . should be promoted by making the extent of the state's contribution dependent upon local action" (p. 117). Updegraff's model provided for a basic appropriation per teacher unit which increased in proportion to the mills levied by individual school districts.

Strayer and Haig (1923) opposed the concept that state finance plans could promote equalization while rewarding

local effort. Instead they advocated "equalization of educational opportunity" as being the primary goal of state school finance models. In their foundation program, both efficiency and the prerogative of local choice co-existed; any district could, through local tax leeway, offer at its own expense a more costly program than the minimum one funded by the state.

Elements of a satisfactory state minimum foundation program were delineated by Mort (1924). Three which advanced efficiency as well as equalization were:

> 1. An educational activity found in most or all communities throughout the state is acceptable as an element of an equalization program.
>
> 2. Unusual expenditures for meeting the general requirements due to causes over which a local community has little or no control may be recognized as required by the equalization program. If they arise from causes reasonable within the control of the community, they cannot be considered as demanded by the equalization program.
>
> 3. Some communities offer more years of schooling or a more costly type of education than is common. If it can be established that unusual conditions require any additional offerings, they may be recognized as a part of the equalization program. (pp. 6-7)

Mort also developed the concept of the "weighted pupil" as a method for determining the number of teachers necessary

for staffing a particular school, or program. The "instructional unit" is currently used in many states as a basis for appropriating state monies among educational programs.

A third school finance model, full state funding, was developed by Morrison (1930) and has subsequently been adopted by the state of Hawaii. With full state funding, complete equalization occurs since local tax leeway is abolished, presenting a district's educational program from being dependent upon the wealth of local revenue sources. It must be noted that while equalization occurs, the abolition of local leeway effectively terminates local freedom of choice. Another problem with full state funding is the very real potential of political partiality on the part of legislators, in placing constituents' educational interests before state-wide educational concerns.

A final school finance plan, district power equalizing closely akin to percentage equalizing, was developed to promote greater equalization, efficiency and local choice (Coons, Clune, & Sugarman, 1970). There are three district features present in the model: (a) the state equalizes any fiscal capacity disparities among districts, thereby causing education to become a function of the state's fiscal capacity; (b) school districts levy whatever tax level they

wish to support; and (c) if a district raises revenue in addition to the level mandated by the local tax rate, then that district must return the additional monies to the state fund. This "recapture provision," along with no restraints upon local effort, have raised objections from school finance researchers, as being in the former case, politically naive; and, in the latter, having the effect of making a child's education contingent upon the whim of local politicians.

During the 1970s, the National Educational Finance Project evaluated existing school finance systems nationwide. From their findings NEFP researchers concluded that the most efficient models for providing equalization of state financial resources are those which included unit cost differentials; and which considered the wealth of a district as a determinant factor in allocating funds (Johns, Morphet, & Alexander, 1983). Complete equalization could only be achieved by full state funding. In regard to local effort and subsequently local choices, NEFP researchers ascertained that increased local effort in proportion to instituted tax limits contributed to greater equalization. However, when there existed a higher percentage of local effort beyond what was required, then equalization decreased.

In addition to general state finance plans, other areas of expenditure were analyzed by educators to improve efficiency. Early school finance researchers explored alternative methods for funding pupil transportation, which had recently become a public sector enterprise. Chapter Three of this text provides a detailed report of the development of pupil transportation and the significant contributions of Burns, Johns and others in defining efficient pupil transportation formulas.

Florida Pupil Transportation Formula

During the 1917-18 school year, the average cost per transported student in Florida stood at $17.08 (Roberts, 1983). No state funds were appropriated for pupil transportation; students were either transported by private means or by transportation furnished and financed by the district. By 1927, the cost per pupil transported had risen to $25.03, with 39,529 students being provided transportation at district expense. In 1936, when administration of pupil transportation was assumed by the State Department of Education, the cost per pupil transported was reduced to $16.70 (Mort & Reusser, 1941). During the next two decades, state expenditures for pupil transportation increased rapidly from 15

percent in 1937-38 to an all-time high of 65 percent for the 1957-58 school year (Roberts, 1983).

In recent years, although legislative appropriations for public school transportation have increased, the actual percentage of expenditures subsidized by the state has decreased. According to a 1982 report published by the Governor's Office of Planning and Budgeting during the 1978-79 school year, the state furnished 56.58 percent of the funds expended state-wide on pupil transportation. By 1981, the state's contribution had shrunk to 45 percent of the total cost of public school transportation in Florida. Roberts (1983) reported a further decrease in the percentage of state aid available for the 1982-83 public school transportation program. Only 41 percent of the cost of pupil transportation was provided for by state appropriations, in spite of a 7.34 percent increase over the previous year in actual dollars appropriated for public school transportation by the state legislature. Inflation, escalating fuel prices, and an increased population served have all been cited as reasons for soaring transportation costs. The present study was undertaken to determine if use of the current Florida pupil transportation formula was

the most efficient method for providing state appropriations equitably among school districts, in view of the variations in student populations it serves, namely handicapped and regular students.

Origin of Present Pupil Transportation Formula

The 1982-83 pupil transportation formula traces its origins back to the 1973 legislature, at which time major changes occurred in the method of financing education in the state of Florida. The Florida Educational Finance Program (FEFP) was instituted that year; incorporated into the law was a greatly improved pupil transportation formula (Johns, 1977). Section 236.083 of the new legislation authorized the state to appropriate monies to provide transportation for (a) regular students living two or more miles from school; (b) physically handicapped students regardless of distance from school; and (c) transportation for vocational and exceptional students to and from centers (Fl. Stat., 1973). The formula used to determine the 1973 allocation of transportation funds was derived from the following mathematical function: $Y = \frac{A}{B+X} + C$; with Y being the computed allowable per pupil cost; A, B, and C

being constants; and X being the density index of each district (Johns, 1977).

In 1977, Johns reevaluated the efficiency of the Florida pupil transportation and advised that the formula be modified somewhat for the sake of parsimony. The new formula adopted by the legislature and currently in use is: $Y = \frac{A}{B} + B$. Again, Y equals the computed allowable cost; X equals the density index for each district; and A and B are constant, the values of which are computed annually to reflect yearly cost differentials.

The 1982-83 pupil transportation formula is nearly identical to the 1977 formula proposed by Johns, the only difference being in the values for the constants A and B. Actual allocations to districts are determined by the following procedures outlined by Section 236.083 of the Florida School Laws (1982):

1. Each district ascertains the membership to be transported. Students to be transported must be identified as belonging to one of the following categories: (a) lives two or more miles from school; (b) is physically handicapped; (c) is a K-6 student, who lives less than two miles from school, but encounters hazardous walking conditions;

or (d) is a vocational or exceptional student who must be transported between school centers.

2. Each district computes the total vehicle mileage allowed. This is obtained by multiplying the number of vehicle miles with students by .5; and adding to this figure the number of vehicle miles without students, which has been multiplied by .25.

3. The Density Index for each district is computed by dividing the total number of transported students by the total number of allowable vehicle miles. Maximum and minimum limits have been set by statute regarding the use of the density index. Districts with a density index below 1.70 must use 1.70 in computing the formula; districts with a density index above 4.70 must use 4.70 in their computation for the formula.

4. The formula then can be computed as follows:

$$\text{Allowable per student cost} = \frac{386.2385}{\text{Density Index}} + 42.50283.$$

Appendix C provides an example of how districts compute the Florida Pupil Transportation Formula.

The Florida Pupil Transportation Formula is considered an efficiency-oriented funding formula, in that it rewards

districts which transport students economically and penalizes those which do not. According to the formula, if a district spends more money per pupil than other districts of the same density, that district must furnish the additional funds from local sources. If a district spends less money than the state-calculated cost per pupil, then that district receives the appropriation designated for its density index group. In actuality, legislative appropriations are never large enough to provide funding for district costs derived from the formula. As stated previously in this chapter, only 41 percent of the costs of pupil transportation were funded by the state appropriation for the 1982-83 school year. School districts which are efficient in transporting students, however, will require less local funds than school districts which allow inefficient practices to continue.

Five areas for potential inefficiency exist: (a) bus routing; (b) the transporting of nonhandicapped students who live less than two miles from school; (c) the use of school buses for field trips and extracurricular activities; (d) bus driver salaries; and (e) the maintenance of buses (Johns, 1977; Alexander, 1983). All of these activities are under the control of the individual school district and,

for that reason, any excess costs attributed to them should be paid with local funds rather than state.

Variations in cost unrelated to district practices are controlled for by the transportation formula. Sparsity is a good example of a cost differential not under the control of a school district. School buses in a rural district must travel additional miles to pick up students in sparsely populated areas. This is in contrast to an urban district whose buses may transport the same number of students as the rural district, but in doing so, generate less mileage. An example depicting how the density index compensates rural districts for sparsity is provided in Appendix D.

District-level efficiency is rewarded when the total cost of a district's transportation program is computed. For this calculation, the total number of miles traveled per day, which includes nonessential miles as well as those counted by the state, is multiplied by 180 days. This mileage figure is then multiplied by the cost per mile driven, resulting in the total amount of dollars needed to fund a specific district's pupil transportation program. Therefore, if a school district observes efficient management practices, that district will realize a savings, whereas, a district of similar density and membership, which is inefficient in its operation, will not. (See Appendix E.)

The Florida Formula and Transportation of Exceptional Students

In recent years, the transportation of exceptional students has become commonplace in most school districts in Florida. The cost of transporting exceptional students is unknown, although State Department of Education officials maintain that the present Florida Transportation Formula with its density index compensates districts for transporting handicapped students.

Following the 1976-77 school year, the staff of the School Transportation Section conducted a study, at the request of the legislature, to determine the costs attributed to exceptional student transportation (Johns, 1977). Data were collected from 15 districts on the costs of operating buses which transport exclusively handicapped students. Wide variations in cost existed among districts, which researchers attributed to three factors: (a) the number of students served per trip; (b) the number of trips per bus; and (c) daily bus miles. A fourth variable included in the study was the annual operating expenditure per student. This figure was derived from adding up the costs for insurance, vehicle maintenance, and equipment depreciation. Researchers reported that the most significant factors involving high costs were the number of students per trip and longer route mileage.

According to Johns (1977), the formula $Y = \frac{A}{X} + b$ has been adequate for calculating both regular and exceptional student transportation because the higher route mileage of school buses transporting exclusively handicapped students was used in computing a district's density index. Greater mileage with fewer students produced a low density index, which, in turn, resulted in a higher allowable cost per student. After analyzing the results of the study, Johns advocated the continued use of the current formula, maintaining that the use of two separate formulas to calculate regular and handicapped cost would foster inefficiency.

The formula, in regard to funding exceptional student transportation, was reviewed again by Johns in 1979. Noting the escalating costs of transporting handicapped students, Johns recommended adding a weighting factor of 5 for each handicapped student to the state allowable cost per student. For example, if the cost per student for a particular district was \$114.50, then the state allowable cost per exceptional student would be \$572.50. This weighting would be used only with exceptional students who were transported on school buses used exclusively by handicapped pupils. Exceptional students who were able to travel on regular school buses would be counted as regular students for funding purposes.

The use of weights for financing the transportation of certain populations has been advocated by other researchers. As observed previously, a National Educational Finance Project study (1973) conducted in Kentucky recommended the use of a weighting factor of 5 for exceptional students. A recent in-depth review of Kentucky's pupil transportation program by Alexander (1983) advocated retaining this weighting factor. Similarly, in a study conducted in Illinois, a weight of 4.294 for handicapped students was recommended for inclusion in the state efficiency-oriented pupil transportation formula (McKeown, 1978).

Although the state of Florida did not incorporate the weighting factor suggested by Johns into the formula, transportation of handicapped students continues to generate interest. During the summer of 1983, the Transportation Management Section, together with the Bureau of Education for Exceptional Students, published a "Technical Assistance Paper" in response to the myriad of questions received from school district personnel regarding the transportation of exceptional students. Chief among the concerns voiced by local transportation directors was the adequacy of the state reimbursement for the transportation of exceptional students. State school transportation officials maintained that the existing formula adequately compensated districts

for the transportation of handicapped students, due to the density index. Officials based their assumption upon the 1977 study conducted by their department, in which mileage proved to be the most significant cost factor in the transportation of exceptional students. The results of this study were previously discussed in this chapter.

Seven years have elapsed since the School Transportation Section's study concluded that the Florida Pupil Transportation Formula met the funding needs of school districts for both regular and handicapped transportation. During that time span, Florida experienced a 19.23 percent rise in membership in state exceptional education program, while the total student population in the state declined 3 percent (Terhune & Floyd, 1983). In 1977, total membership in programs for exceptional students stood at 137,254; by 1982, this figure had risen to 163,645. The programs which experienced the largest gains in membership were programs for the profoundly handicapped students whose membership increased 126 percent during the seven years.

The impact of these additional exceptional students upon district transportation programs has not been studied. Neither has the actual cost of transporting exceptional students been determined. The 1977 study conducted by the

School Transportation Section did not include salaries of school bus drivers and aides, both of which contribute to transportation costs. The purpose of the present study is twofold: (a) to determine the actual cost of exceptional student transportation in representative school districts in Florida and (b) to develop and implement through simulation, alternate models for funding exceptional student transportation. Through the undertaking and execution of these two procedures, the efficacy of using the current Florida Pupil Transportation Formula can be determined.

Alternative Pupil Transportation Models

To determine which is the best model for funding pupil transportation, two procedures must transpire. First, the current pupil transportation formula must be reevaluated to ascertain its effectiveness in funding transportation. Second, an alternative model must be derived, for possible utlization and as a point of comparison in weighing the merits of the current transportation formula. In both procedures, regression analysis should be used.

There are several reasons for this. First, linear regression is the statistical procedure used to analyze the relationship between variables. In the present study the

relationship between the independent variable, density, and the dependent variable, cost per pupil transported, is being studied to determine if density is the single best predictor of pupil transportation costs. Previous research on pupil transportation has indicated this to be the case (Farley, Alexander & Bowen, 1973; Frohreich, 1973; Stollar, 1971).

A simple regression equation is a straight line: $y = ax + b$, in which y is the dependent variable; and x is the independent variable. For each change in x, there is a corresponding change in y. The term "a" or the slope expresses this change; "b" or the intercept is the point at which the straight line crosses the y axis.

When the values of x and y are graphed, a scatterplot is produced. By plotting the original regression equation, a regression line, or "line of best fit" will be depicted. The principal of least squares can then be used to determine which model produces the best-fitting straight line. The closer the values for y are to the regression line, the stronger the relationship between x and y; and the better the predictive ability of x for y.

Second, Regression Analysis also permits the researcher to use noncategorical, or continuous variables in the

equation. A continuous variable differs in degree and has an infinite number of values; whereas a categorical value is classified according to its identity with a specific group (Pedhazur, 1982). Density is a continuous variable.

A third reason Regression Analysis is the preferred statistical method for this study is its ability to depict a relationship existing between the dependent variable and several independent variables. Multiple Regression will be useful to this study to determine if density alone is the best predictor of y, or if a combination of several variables is better. A statistical calculation useful in ascertaining this is the R-Square.

The R-Square statistic provides information concerning how much of the variation in the dependent variable can be explained by a particular model. Values for the R-Square are anywhere between zero and one. The higher the R-Square, the more variability is accounted for in the dependent variable. Consequently, a high R-Square, that is, one approaching the whole number one, denotes a good fit of the model. In the present study, the R-Square is being used to determine which is the best model for predicting costs per pupil transported.

Polynomial Regression, a type of multiple regression which can be used with curvilinear relationships, is being used to ascertain if the value of the density, when raised to a power, improves the model. School finance researchers have reported that the line of best fit between density and cost per pupil transported is a curve, rather than a straight line (Burns, 1927; Johns, 1928).

In conclusion, two overall models are being tested. First, a simple linear regression model is being evaluated to determine its adequacy in predicting the cost per transported pupil: $y = ax + b$. Second, the model currently used to fund pupil transportation in Florida is being evaluated: $y = \frac{a}{x} + b$. Polynomial equations are being introduced in both models to ascertain if either of the two models can be improved by the addition of exponents.

Application of the Models

The two different models are being evaluated with three populations: (a) transported regular students only, (b) transported exceptional students only, and (c) all transported students. By using the three different populations, it can be determined if variables proven to be significant cost factors in one situation, continue to be so with different pupil transportation populations. Advocates of the present formula maintain that one variable,

density, is the most significant cost factor with any of the three populations. Of great interest to the present study is discovering the impact exceptional student transportation has upon pupil transportation in general. This information can be attained by separating out the exceptional student population from the general pupil population and observing the results.

A second piece of information of primary importance to this study is knowledge concerning the cost factors of exceptional student transportation. The efficacy of attributing the cost of exceptional student transportation to one variable, density, can be determined by isolating the exceptional student population from the overall pupil transportation population.

Description of the Sample

In order to have a representative sample of Florida school districts, a stratified sampling according to student population was carried out. This procedure was necessary because of great variability in student population figures existing among counties. Such variation has a definite impact upon the cost involved when transporting students.

According to the 1980 U.S. Census, much of Florida's population is located in or around urban centers (Terhune & Floyd, 1982). Urban regions containing a population of

50,000 or more have been designated by the U.S. Office of Management and Budget as Standard Metropolitan Statistical Areas (AMSAs). There are 18 SMSAs in Florida. Three of the 18 SMSAs contain a population of one million or more: Fort Lauderdale-Hollywood, Miami, and Tampa-St. Petersburg. Dade County with a population of 1,625,718 is the most populated county; Lafayette with 4,035 inhabitants is the least populated.

As mentioned previously, there are 67 school districts in Florida. Each district encompasses one geographical county of the state. Of these districts, 28 are located within SMSAs, leaving the impression that they are highly populated counties. When considered individually as school districts, a trend towards a more rural population emerges (see Appendix F).

Student population figures for the 1982-83 school year show that 37 of the 67 school districts enrolled less than 10,000 students. Forty-three or 64 percent of the districts registered under 15,000 students during the 1982-83 school year. Fifty-four or 80 percent of the school districts showed attendance figures under 30,000. The remaining 13 school districts registered student populations in excess of 30,000.

Four counties recorded student population figures exceeding 100,000: (1) Dade County--262,144.05 students; (2) Broward County--141,182.14 students; (3) Hillsborough County--119,809.59 students; and (4) Duval County--101,246.77 students. Each of these counties contains a major metropolitan area within its borders.

Due to the difficulty in obtaining accurate data from all 67 counties in Florida, a sample of 30 school districts was used as the data base for the present study. In order to assure representativeness, school districts were stratified by 1982-83 student population figures. School districts with populations of 25,000 or more were placed in categories according to intervals of 25,000. There are 16 school districts in Florida with student populations of at least 25,000. The remaining 51 school districts were placed in categories according to intervals of 5,000. This procedure was followed due to the scarcity of school districts with large student memberships and because of the high concentration of school districts with student populations of less than 15,000 students. Such a breakdown delineates a more accurate representation of the school districts than if six categories were used; i.e., (a) 1,000-50,000, (b) 50,000-100,000, (c) 100,000-150,000, (d) 150,000-200,000, (e) 200,000-250,000, and (f) 250,000-300,000, since only eight school districts have student populations above 50,000 (see Appendix F).

Once the 12 categories had been designated, a sample, composed of 30 school districts, was formed. The number 30 has been suggested by researchers as a viable number for ensuring representativeness in a sample. The larger the sample, the more accurate the representativeness, in most cases. According to Ary, Jacobs and Razavieh (1979), a sample consisting of 10 to 20 percent of the accessible population should be representative of the population. With a sample size of 30 in the present study, 45 percent of the population has been included.

Table 5 provides a list of the 30 school districts selected for the sample. These districts were chosen on the basis of (a) the number of school districts included in a particular category, (b) the availability of data, and (c) willingness on the part of the district to share the information. Although the sample appears skewed, with the majority of the school districts in the lower categories, this skewness is merely a reflection of the extremes of student population figures for the school districts. For example, in the category 1,000-5,000, there are 24 school districts included. By selecting 13 of the districts for the sample, a good representation of this category has been achieved. On the other hand, in the 150,000+ category,

Table 5. School Districts Included in Sample

Category	County	Student population
150,000 +	Dade	262,144.05
125,000-150,000	Broward	141,182.14
100,000-125,000	Duval	101,246.07
75,000-100,000	Orange	88,342.87
50,000-75,000	Polk	61,540.55
25,000-50,000	Brevard	44,537.40
	Pasco	29,180.00
20,000-25,000	Okaloosa	23,156.40
	Alachua	23,018.47
	Bay	21,159.81
15,000-20,000	Clay	17,387.75
10,000-15,000	Putnam	10,361.10
5,000-10,000	Indian River	9,517.40
	Charlotte	8,328.81
	Highlands	7,644.75
	Hendry	5,089.86
1,000-5,000	Hardee	4,599.25
	Sumter	4,593.54
	DeSoto	4,293.94
	Baker	3,628.84
	Taylor	3,558.10
1,000-	Glades	863.56

Dade County School District with a student population of 262,000 is the only school district of its size. Therefore, Dade County was the only school district selected for the sample from that category.

Geographically, all areas of Florida are represented by the sample. For the sake of analysis, the authors of the Florida Statistical Abstract series have divided the 67 counties of Florida into geographical regions known as "Planning Districts." The sample of this study includes school districts from each of the 11 planning districts.

The state of Florida encompasses 58,664 square miles; 54,153 square miles of land and 4,511 square miles of water. The topography of Florida is relatively homogeneous. Average elevation of 100 feet above sea level, with the lowest point being sea level and the highest point reaching an elevation of 345 feet (Terhune & Floyd, 1982). Consequently, there are no geographical barriers causing additional expense, as is the case with other states, i.e., Colorado.

Density Index for Exceptional Students

It was necessary to collect from each of the 30 school districts information for deriving a density index and the cost per exceptional student transported for each county. Two types of information were needed: (a) demographical and (b) financial.

Under demographical information, figures for the total student membership transported and the overall daily mileage traveled must be known in order to compute a density index. This information for exceptional students was not available at the Department of Education School Transportation Section. Figures for the total student membership transported by each district as well as mileage totals are available, but since exceptional students are treated exactly like regular students for funding purposes, there is no breakdown of figures for exceptional or regular students.

Therefore, it was necessary to collect this information from each district. Records are supposed to be maintained on each bus, for state audit purposes. The typical kinds of information kept in these records are (a) mileage, (b) number of students transported, (c) operational costs, and sometimes (d) salaries of bus drivers and aides. In this case, the data required was for the 1982-83 school year.

A form, which is included in Appendix G, was developed for the collection of student membership/mileage information. Data were gathered on each school bus transporting exclusively handicapped students. Five types of data were collected: (a) the identification number of the bus, (b) type of vehicle, (c) length of term, (d) number of handicapped students transported, and (e) total daily miles.

The form was sent to the pupil transportation supervisor in each of the 30 districts. If a form was not returned after a sufficient amount of time had elapsed (a month), then the school transportation supervisor was contacted by telephone and a new form was sent, if needed.

Cost per Exceptional Student Transported

In order to derive the cost per exceptional student transported, it was necessary to collect data on fuel and maintenance costs and salaries of bus drivers and aides for each bus transporting handicapped students. This information was only available at the district level. Annual cost figures for the 1982-83 school year were collected from each district over a period of several months. The rapidity with which this information was gathered depended primarily upon record-keeping methods utilized by individual school districts. Districts with data-processing units tended to return the information more quickly than districts who used manual record-keeping methods.

Density Index and Cost Figures for Regular Students

Other data needed for the study were available at the Department of Education School Transportation Section, or the Finance Section. Mileage and student membership figures for regular students were gathered from the 1982-83 Florida

Department of Education FEFP Transportation Survey handed in to the Finance Department by each of the school districts. These surveys are reported to the department every October and February.

Cost figures for all students transported are calculated by the School Finance Section of the State Department of Education. Calculations are based upon District FEFP Transportation Survey figures and expenditure reports required of the districts by the State Department.

Summary

The development of the alternative pupil transportation models described in this chapter involved five steps: (a) an examination of the topic "Educational Efficiency," (b) an in-depth review of the Florida Pupil Transportation Formula, (c) the derivation of an alternative model, (d) a description of the sample selected for study, and (e) a description of the data collection procedures. Educational efficiency and its importance to the development of school finance formulae has been noted since the early twentieth century. School finance pioneers E. P. Cubberley, Harlan Updegraff, George Strayer, Robert Haig, and Paul Mort all stressed the need for efficiency as well as equalization.

Efficiency in pupil transportation formulas has been advocated by many school finance researchers. Many of the same concepts inherent to state finance plans are present in methods used to fund pupil transportation. Robert Burns and Roe L. Johns, researchers during the 1930s, pointed out the importance of density in relation to the cost of school transportation. NEFP researchers during the 1970s concurred with Burns and Johns's earlier findings.

One of the states utilizing a density index is Florida. The Florida formula treats regular and exceptional students alike, maintaining that by using the density index, the extra miles traveled by school buses transporting exceptional students does not penalize districts. The present study was undertaken to determine the efficacy of this concept.

In the present study, two different models are under investigation. The first is an alternative linear regression model: $y = ax + b$. The second is the current linear regression model used by Florida: $y = \frac{a}{x} + b$. Polynomial variables are being entered in both models. Three different populations are being used to test the effect of density upon the cost per pupil transported: (a) regular students only, (b) exceptional students only, and (c) both regular and exceptional students.

A sample of 30 school districts is being used as a data base for the study. These school districts were chosen on the basis of stratified sampling by student population and represent all geographical regions of the state of Florida. Data collection procedures include the gathering of the following data from the school districts: (a) number of exceptional students transported, (b) total daily mileage for exceptional students, (c) fuel costs, (d) maintenance costs, and (e) salaries of bus drivers and aides. All data are for the 1982-83 school year. Data needed for regular students have been gathered from the State Department of Education and include (a) 1982-83 FEFP transportation surveys from the school districts and (b) 1982-83 cost per pupil transported figures for each district.

An application of the Florida formula and the alternative model is presented in Chapter V. Each model was tested using all three student populations, in order to ascertain whether with the costs of exceptional student transportation, the current formula is still viable; or if a better more efficient and equitable model exists for funding both regular both regular and exceptional student transportation.

CHAPTER V

APPLICATION OF ALTERNATIVE PUPIL TRANSPORTATION MODELS

In Chapter IV, the Florida pupil transportation formula was examined in relation to its efficiency in providing equitable funding for exceptional student transportation. One other model emerged as a possible alternative formula upon which to base state funding. Three student populations were chosen and a stratified sample of 30 school districts was selected for testing the current Florida formula, as well as the alternative model. The results of these applications of the two models are the subject of this chapter.

The chapter is divided into six sections. The first three sections describe the statistical procedures used in applying the two models to each of the populations: (a) all students transported, (b) regular students transported, and (c) exceptional students transported, and discuss the results obtained with each population. The fourth section examines the overall effect of density upon the transportation costs of each population. Section five

discusses the efficacy of using the current pupil transportation formula to fund handicapped transportation, and section six of the chapter provides a summary of the five previous sections.

Testing of the Two Models with All Students Transported

The two models were first tested with a population comprised of both regular and exceptional students transported. The dependent variable or y was "cost per pupil transported"; the independent variable or x was density. "Cost per pupil transported" is the total transportation cost computed per student for a specific district, according to the current Florida pupil transportation formula. The density index for each district is calculated by dividing the total student membership transported in a particular district by the total daily mileage traveled. Total daily mileage is obtained by summing one half of the mileage traveled with students and one fourth the mileage traveled without students. Density and "cost per student transported" figures of the 30 sample school districts for the 1982-83 school year are presented in Table 6.

Alternative Linear Regression Model

The initial model tested was an alternative linear regression model: $y_1 = ax + b$. The level of significance

Table 6. Cost per Pupil Transported and Density Index for Sample School Districts for the 1982-83 School Year

County	Cost per pupil transported	Density index
Alachua	$173.10	3.12
Baker	295.65	2.91
Bay	215.52	3.10
Brevard	209.17	2.90
Broward	215.85	3.70
Calhoun	225.76	2.31
Charlotte	192.52	3.10
Clay	219.68	3.44
Dade	286.60	2.79
DeSoto	226.53	3.10
Duval	172.49	2.96
Glades	482.90	1.30
Gulf	219.99	2.57
Hamilton	404.98	2.14
Hardee	233.19	3.20
Hendry	289.77	2.83
Highland	200.93	3.09

Table 6 (continued)

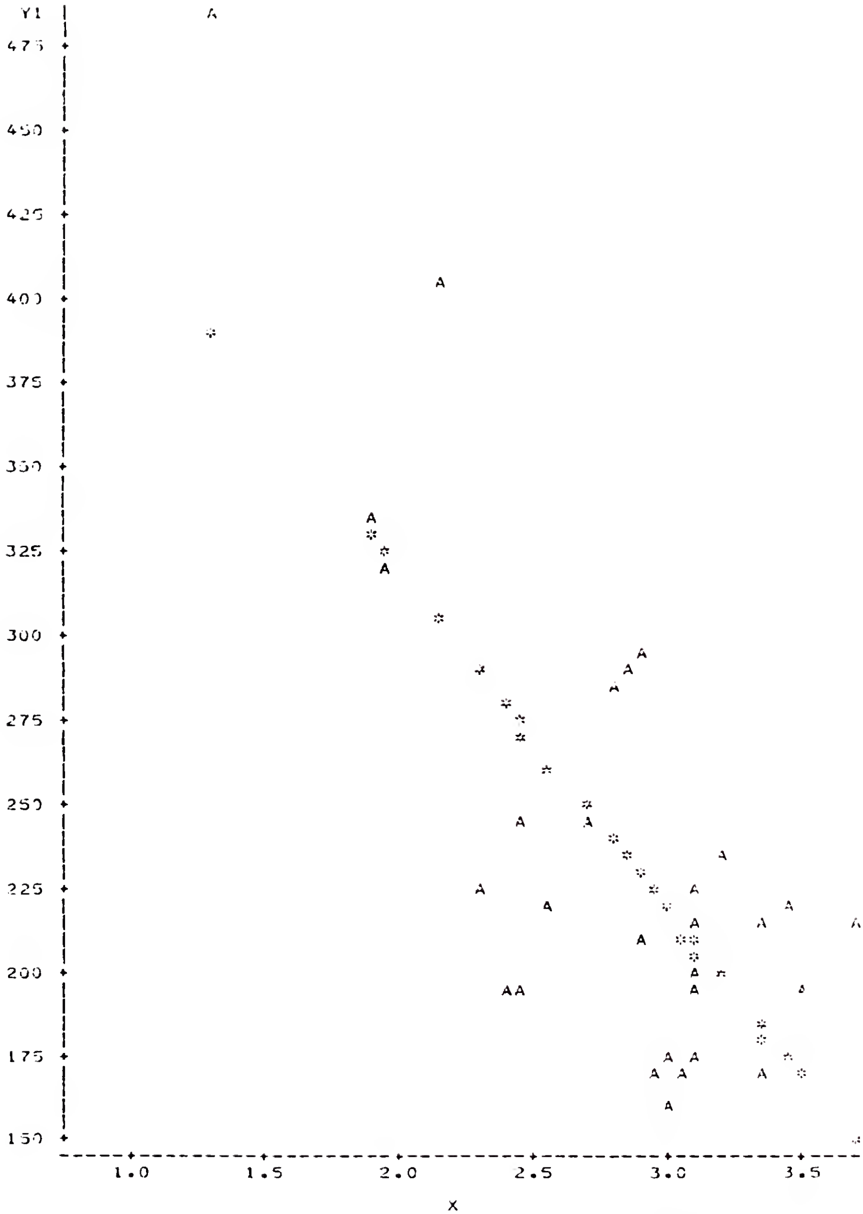
County	Cost per pupil transported	Density index
Indian River	172.19	3.07
Jefferson	319.23	1.93
Madison	245.46	2.47
Okaloosa	174.12	3.00
Okeechobee	195.57	2.38
Orange	194.77	3.49
Pasco	245.59	2.68
Polk	169.57	3.37
Putnam	193.24	2.44
Sumter	159.73	3.00
Suwannee	333.18	1.90
Taylor	213.28	3.36

used in this model and all subsequent models in the study was .05.

In the alternative linear regression model, an R-square of .5395 was reported. This measure indicates that approximately 54 percent of the variation in y can be predicted by x. Stated in terms of the variables in this particular model, approximately 54 percent of the variation among these districts in cost per pupil transported can be predicted by using the density index. Density, then, accounts for 54 percent of the variation in cost among the 29 school districts.

The R-square statistic also denotes the relationship between the actual regression line and scatterplot of the data. The higher the R-square, the better the "fit" of the regression line to the data. A perfect fit would be achieved with an R-square of 1. In this particular case, the R-square is moderate; consequently, there is moderate fit of the data to the regression line. A scatterplot with the regression line overlaid upon it is presented in Figure 1.

When a polynomial variable was added to the model, the overall model was strengthened. With the addition of the variable x^2, the R-square increased from the previous .5395 to .6745. This is approximately a 14 percent increase in



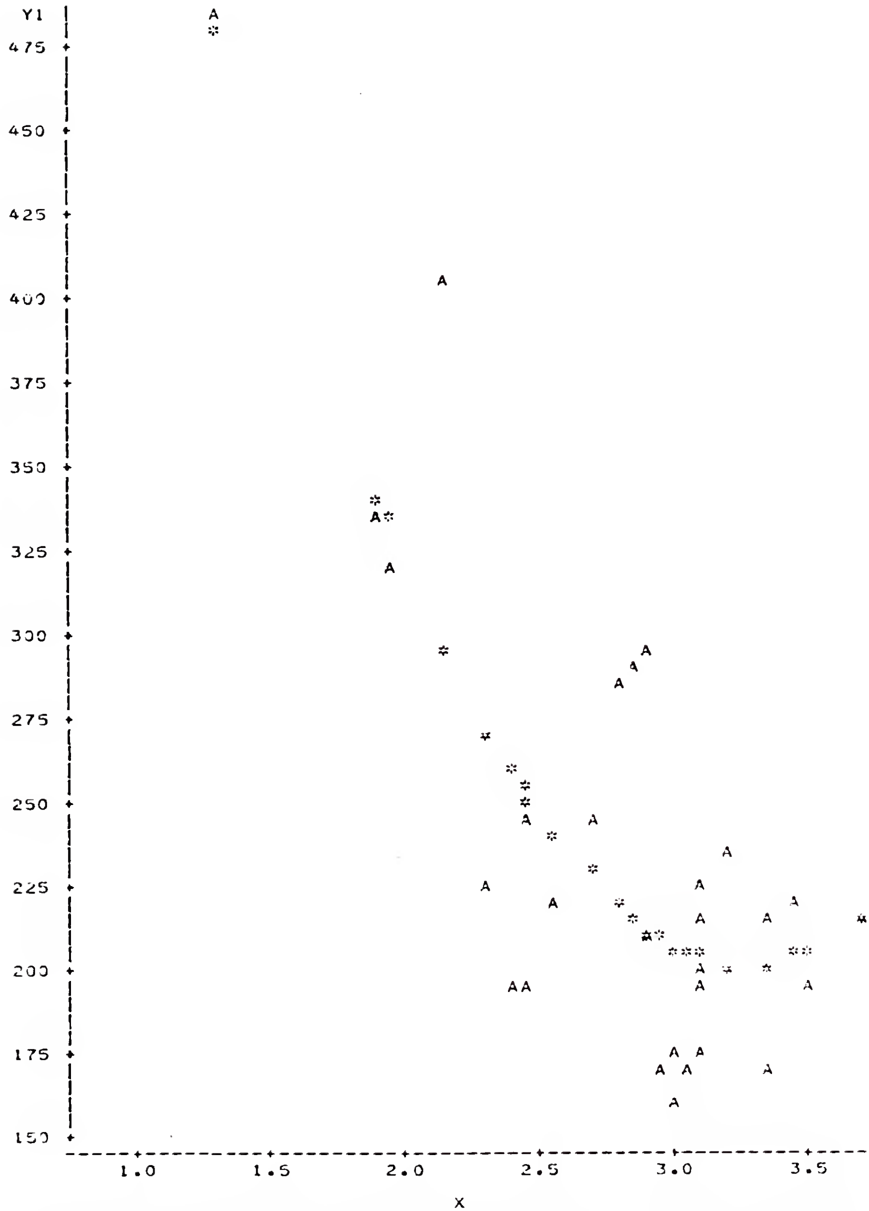
Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 5 observations hidden.

Figure 1. Plot of $y_1 = ax + b$

R-square, signifying that the equation $y_1 = ax_1 + ax_2^2 + b$ is a stronger model for predicting costs than $y_1 = ax + b$.

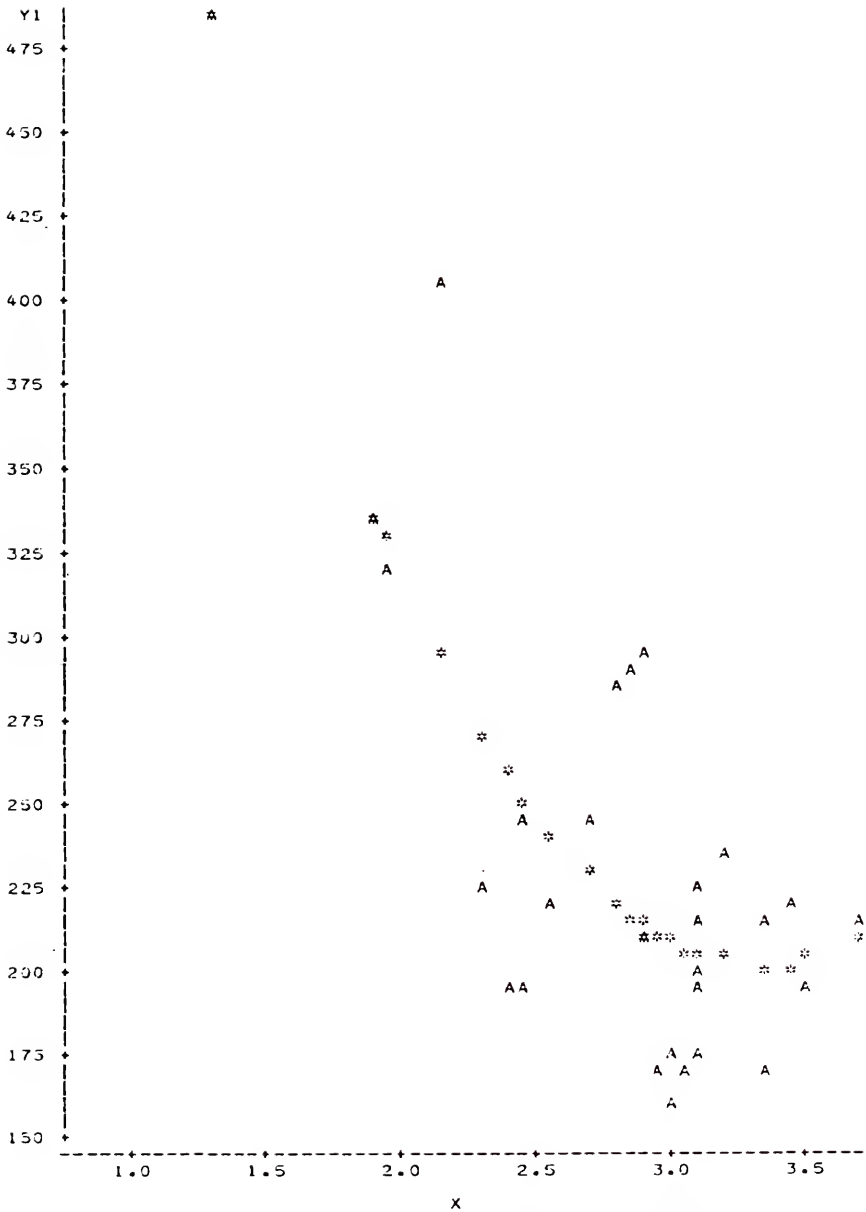
In Figure 2, a scatterplot of the data with an overlay of the regression line reveals that the relationship between the dependent variable y_1, "cost per pupil transported," and the independent variable x, density, is curvilinear. When Figure 1 and Figure 2 are compared, it can be seen that the regression curve in Figure 2 fits the data better than the regression line in Figure 1. With an R-square of .6745, this model is able to predict approximately 67 percent of the cost variation among districts by using the density index.

When a second polynomial variable, x^3, is entered into the model, the results are not significant. The R-square for this model is .6747, which is an increase of .0002. In Figure 3, a scatterplot for this model exhibits a regression curve and data plot similar to that of the scatterplot depicting the results of the model $y_1 = ax_1 + ax_2^2 + b$. The addition of a second polynomial variable, x^3, does not add strength to the original model for predicting costs.



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 7 observations hidden.

Figure 2. Plot of $y_1 = ax_1 + ax_2^2 + b$



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 7 observations hidden.

Figure 3. Plot of $y_1 = ax_1 + ax_2^2 + ax_3^3 + b$

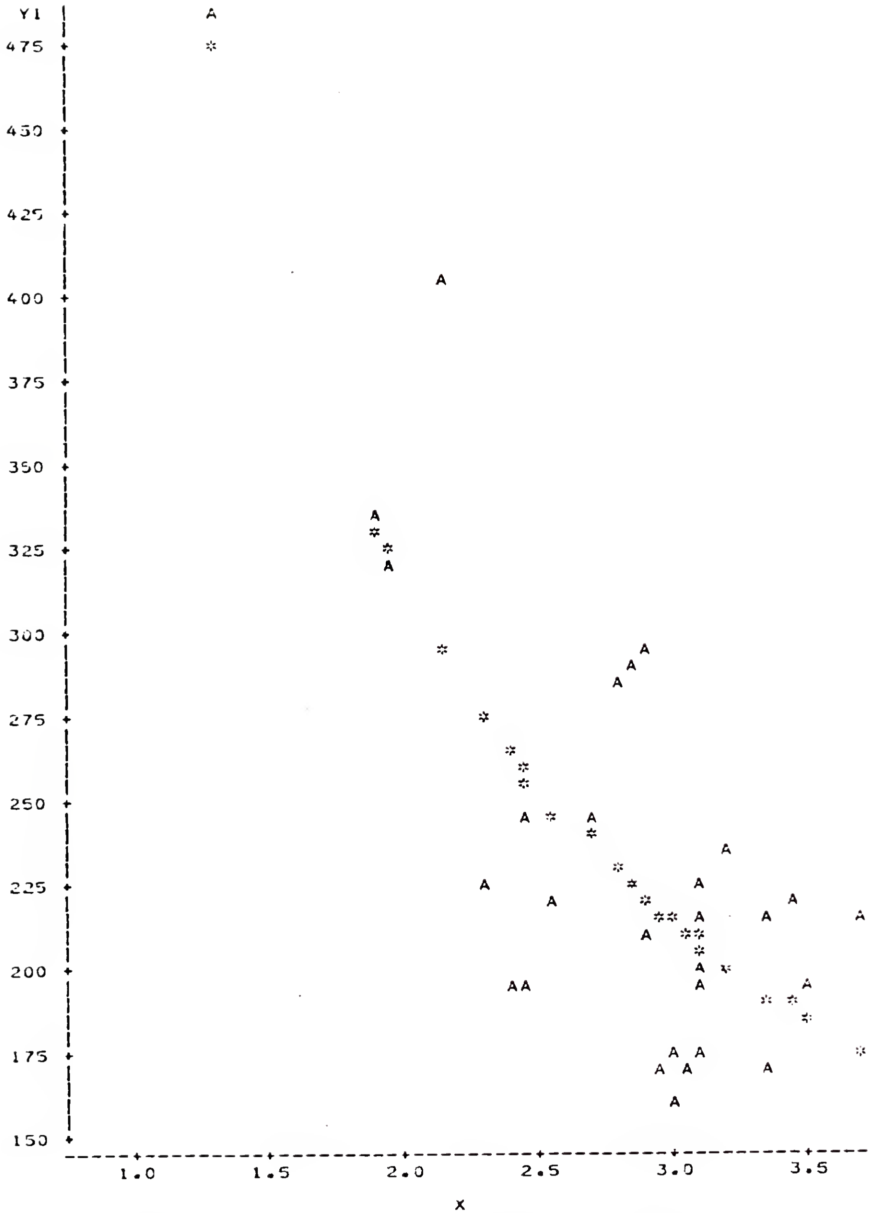
Florida Transportation Linear Regression Model

The current Florida transportation formula is represented by the model $y_1 = \frac{a}{x} + b$. The R-square obtained with this model was .6554, meaning that approximately 65 percent of the variation in cost can be explained by density. Figure 4 provides a scatterplot of the model with an overlay of the regression curve. The regression curve of this model is an adequate fit, comparable to that obtained using the model $y_1 = ax_1 + ax_2^2 + b$.

With the introduction of the polynomial variable xp^2, the model was not significantly strengthened. The R-square increased one point when the variable was entered into the model, which is not a significant increase. A scatterplot for this model as depicted in Figure 5 does not show a significant improvement in fit over the previous model $y_1 = \frac{a}{x} + b$. Since the addition of the variable xp^2 failed to make a significant difference, no other polynomials were entered into the model.

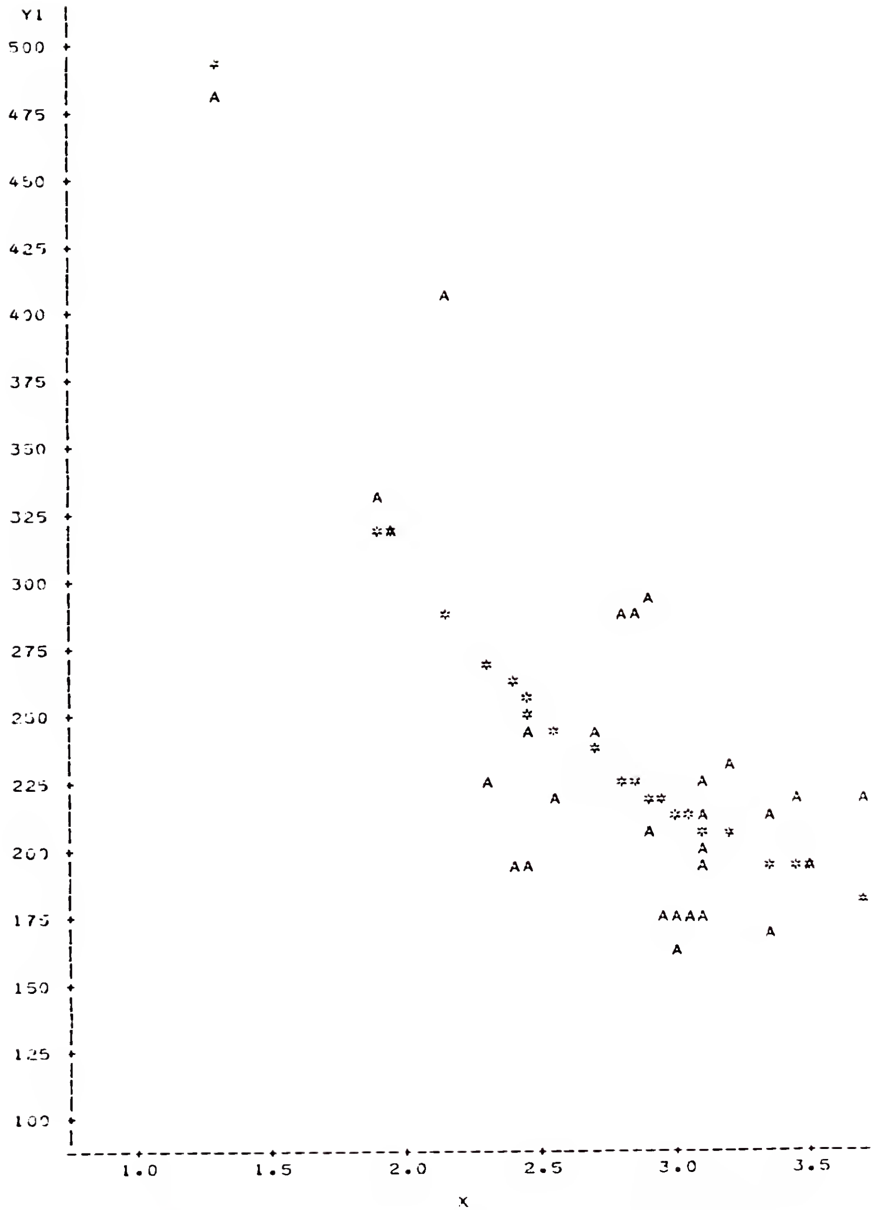
Comparison of the Two Models Used with All Students Transported

In the previous section, two different kinds of models were tested upon a population consisting of both regular and exceptional students transported. The model which



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 6 observations hidden

Figure 4. Plot of $y_1 = \frac{a}{x} + b$



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 7 observations hidden.

Figure 5. Plot of $y_1 = \frac{a}{x_1} + \frac{a_2}{x_2^2} + b$

exhibited the best fit of the regression curve to the data was $y_1 = ax_1 + ax_2^2 + b$. This model reported an R-square of .6745, indicating that by using this model, 67 percent of the dependent variable y can be predicted by the independent variable x. Therefore, 67 percent of the cost per pupil transported (y) can be explained in terms of density (x).

A second model which is more parsimonious and achieves nearly identical results is the current Florida transportation model $y_1 = \frac{a}{x} + b$. With this model, an R-square of .6554 was achieved, meaning that approximately 66 percent of transportation costs for all students transported can be explained by density.

Testing of the Two Models with Regular Students Only

After testing the two models with a population comprised of both regular and exceptional students transported, the models were tested with each group of students alone to discern if density accounted for a large portion of the costs attributed to either regular or exceptional student transportation. The following section will discuss the results of applying the two models to a population consisting of regular students transported only.

In order to test the models, new dependent and independent variables had to be computed, so as not to reflect

any exceptional student transportation costs. A cost per pupil transported was calculated for regular students by subtracting the total cost of exceptional student transportation from the cost of the total pupil transportation program for each county. As described in Chapter IV, exceptional student transportation costs were calculated by summing three different cost factors: (a) fuel costs, (b) maintenance costs, and (c) salaries of bus drivers and aides.

The next step taken in calculating cost per regular pupil transported was to subtract the number of exceptional students transported in each district from the total number of students transported. This figure was then divided into the cost figure derived by subtracting exceptional student transportation costs from the total student transportation program costs for each district. The following diagram depicts the procedure:

1. cost of total student transportation program

   -cost of exceptional student transportation

   cost of regular student transportation;

2. total number of students transported by district

   -exceptional students transported by district

   regular students transported by district;

3. cost of regular transportation program
÷number of regular students transported
=cost per regular student transported.

Density index was computed by first subtracting exceptional student miles from the total mileage traveled for each district:

total mileage traveled for district
-<u>exceptional student mileage</u>
regular student mileage.

Second, the number of regular students transported was divided by the number of miles traveled by regular students:

number of regular students transported
÷regular miles traveled
=density index.

Table 7 presents a listing of both the cost per regular pupil transported and the density index for each school district.

Once the cost per regular student transported and the density index for regular students were computed, the two models were tested with a population consisting of only regular students transported.

Table 7. Cost per Regular Student Transported and Density Index for Sample School Districts for the 1982-83 School Year

School district	Cost per regular student transported	Density index for regular students
Alachua	$162.39	3.65
Baker	274.25	3.29
Bay	204.53	3.55
Brevard	172.95	3.65
Broward	176.62	4.85
Calhoun	224.22	2.32
Charlotte	185.87	3.36
Clay	198.20	4.74
Dade	240.48	4.56
DeSoto	206.83	3.6
Duval	148.55	4.56
Glades	458.41	1.41
Gulf	202.49	3.51
Hamilton	407.87	2.13
Hardee	229.52	3.39
Hendry	284.10	2.96

Table 7 (continued)

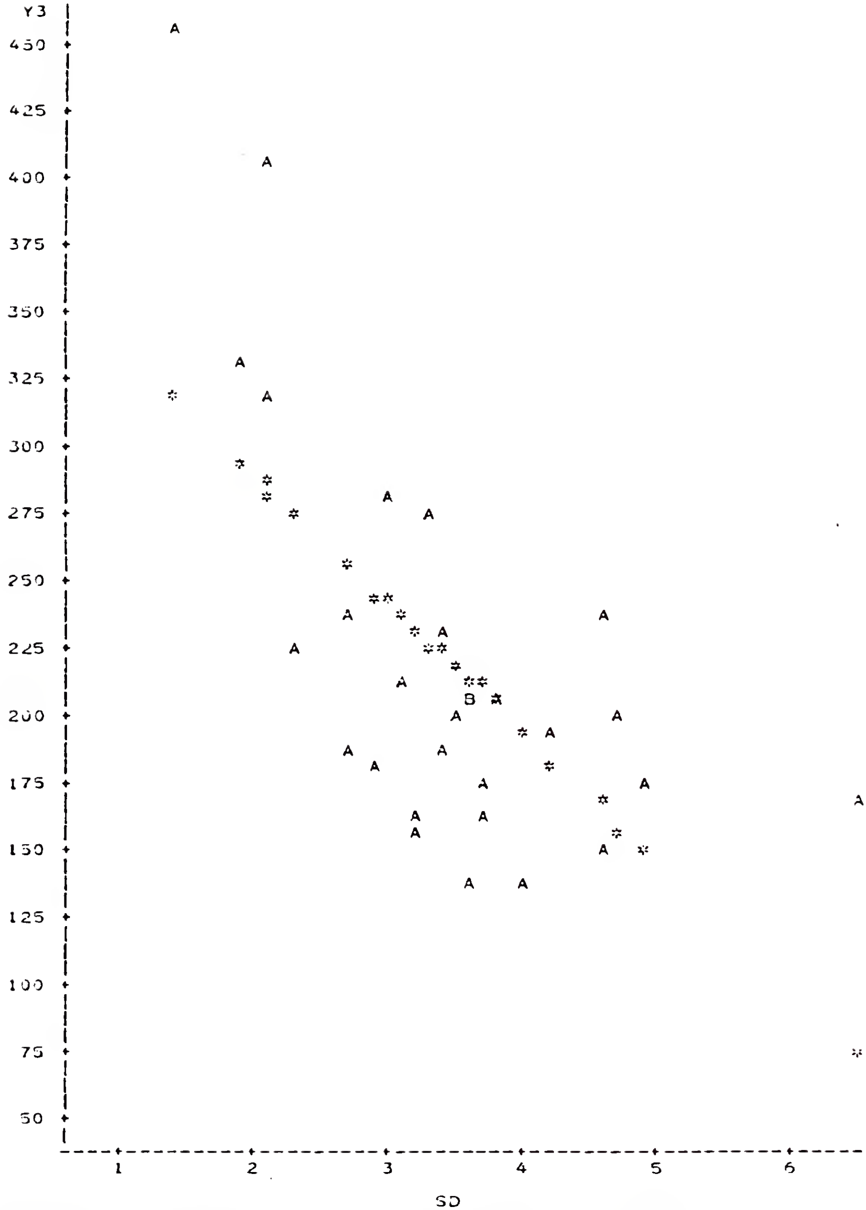
School district	Cost per regular student transported	Density index for regular students
Highlands	194.37	4.19
Indian River	137.67	3.55
Jefferson	319.01	2.06
Madison	236.47	2.69
Okaloosa	163.52	3.24
Okeechobee	187.46	2.73
Orange	166.22	6.49
Pasco	211.42	3.05
Polk	137.27	4.04
Putnam	181.91	2.91
Sumter	155.11	3.21
Suwannee	331.51	1.94
Taylor	203.93	3.76

Alternative Linear Regression Model

The first model found to be significant was an alternative linear regression model $y_3 = a(SD) + b$, in which SD is a district's density index for regular students and y_3 is the cost per regular student transported. The R-square for this model was .4198, meaning that approximately 42 percent of the costs of regular pupil transportation can be predicted by density.

A scatterplot of the data for this model, which is depicted in Figure 6, reveals that the regression line does not adequately fit the data. There are several data points located at either extreme of the regression line, which the regression line does not reach. The poor fit of the regression line, coupled with the low R-square, indicates that if, in fact, density is a good predictor of the costs attributed to regular pupil transportation, then this particular model needs to be improved.

The addition of the polynomial variable SD^2 provides a considerable improvement to the original model. With this model $y_3 = a(SD_1) + a(SD_2^2) + b$, an R-square of .6607 was obtained. This is an increase in R-square of approximately 24 points, which means that by using this model, 66 percent of the costs of regular pupil transportation can be explained by density.



Legend: A=1 observations, B=2 observations, etc. Symbol used is *.
Note: 7 observations hidden.

Fiugre 6. Plot of $y_3 = a(SD) + b$

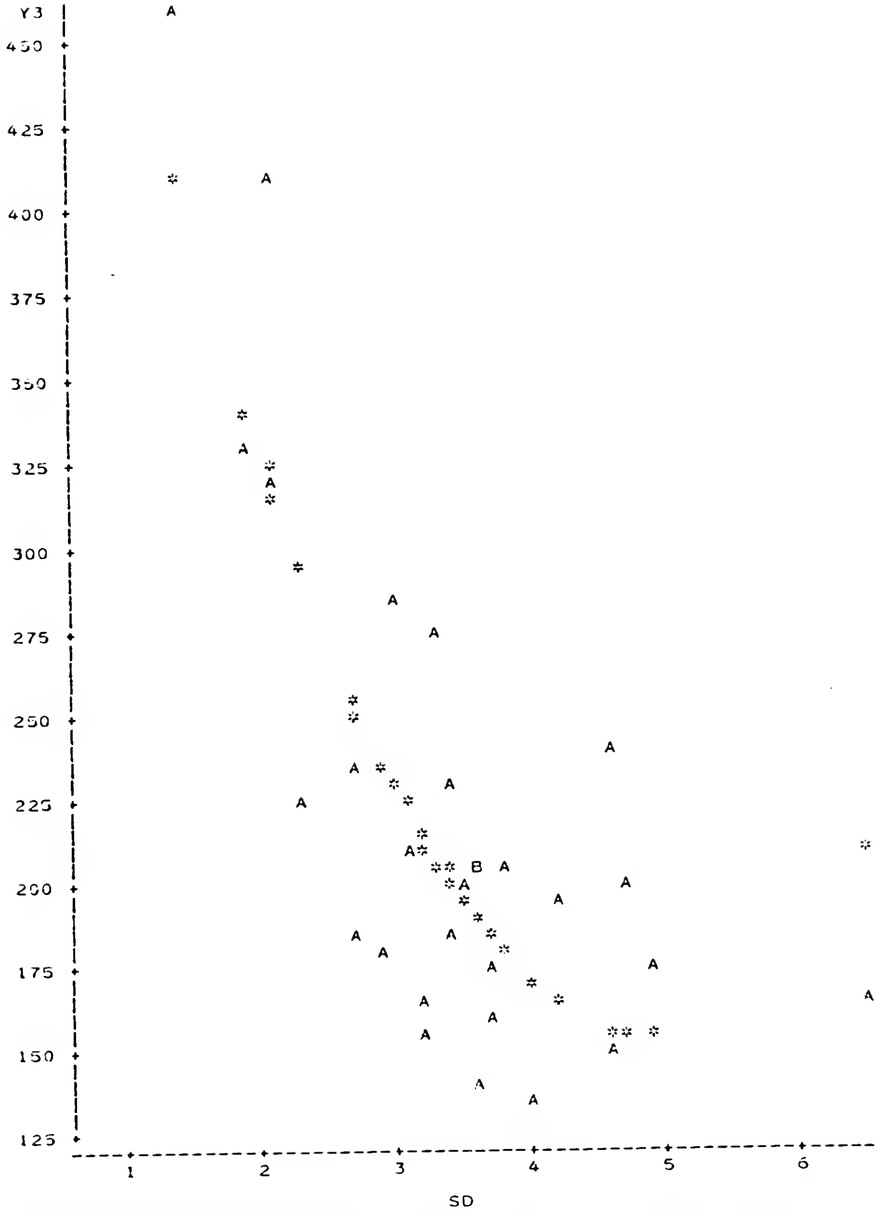
A scatterplot for this new model, as depicted in Figure 7, shows that the addition of a polynomial variable changes the regression line into a curve, which more accurately depicts the relationship between cost per regular student transported and density.

The inclusion of a second polynomial variable SD^3 also proved to significantly strengthen the original model. With the model $y_3 = a(SD_1) + a(SD_2^2) + a(SD_3^3) + b$, an R-square of .7355 was achieved. This means that approximately 74 percent of the transportation costs of regular students can be explained in terms of density.

As can be seen from studying Figure 8, the regression curve for this model exhibits a good fit with the data points. When Figures 7 and 8 are compared, it can be seen that the model $y_3 = a(SD_1) + a(SD_2^2) + a(SD_3^3) + b$ achieves a better fit than the two previous models $y_3 = a(SD) + b$ and $y_3 = a(SD_1) + a(SD_2^2) + b$.

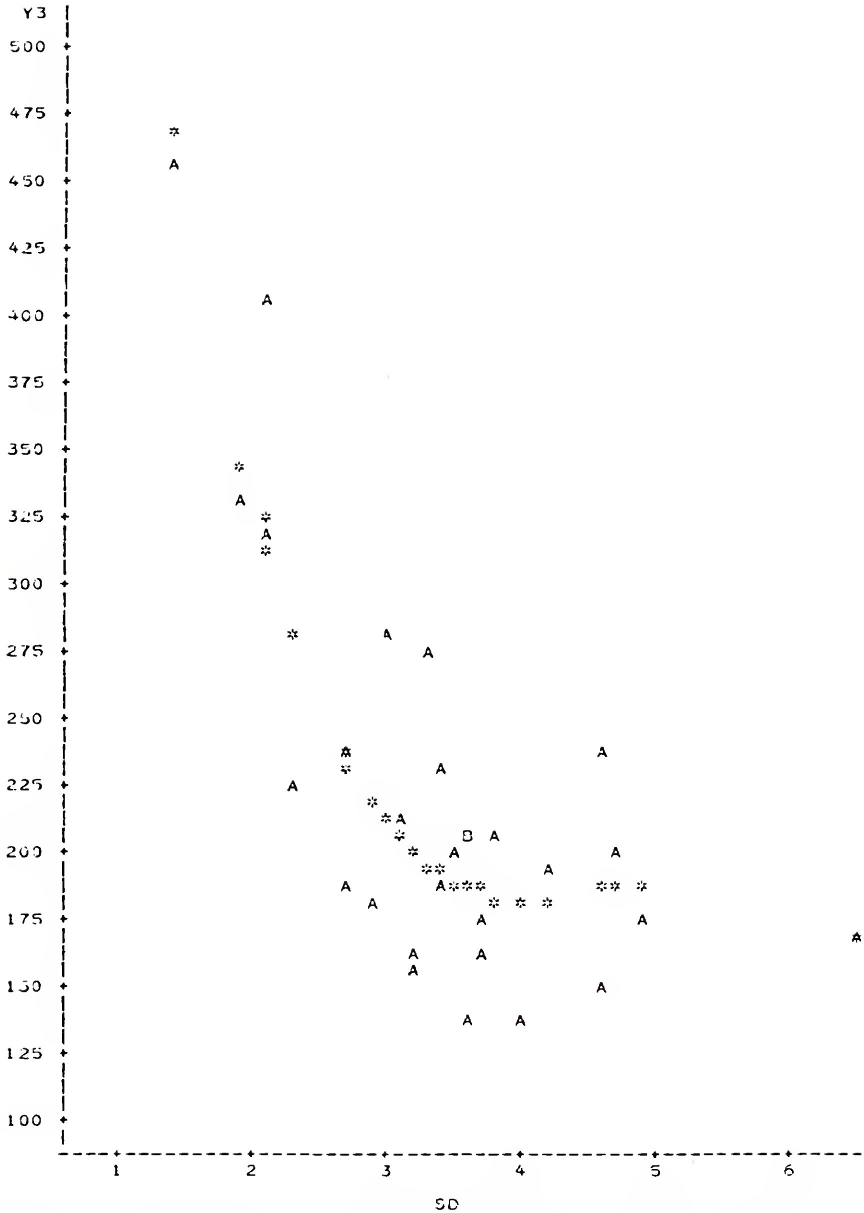
Florida Transportation Linear Regression Model

When the Florida transportation linear regression model was tested with regular students transported, an R-square of .6795 was achieved. This means that by using this model, approximately 68 percent of transportation costs incurred by regular students can be explained in terms of density.



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 7 observations hidden.

Figure 7. Plot of $y_3 = a(SD_1) + a(SD_2^2) + b$



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 6 observations hidden.

Figure 8. Plot of $y_3 = a(SD_1) + a(SD_2^2) + a(SD_3^3) + b$

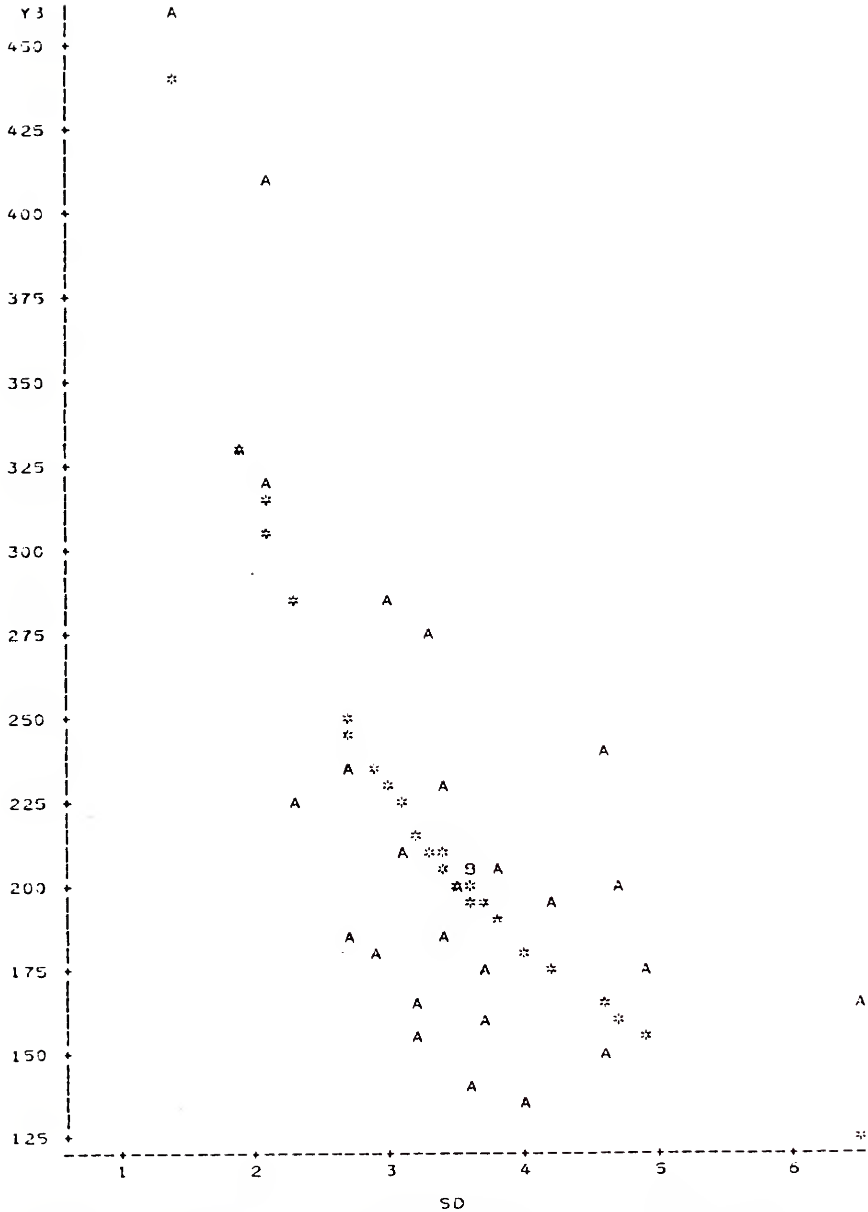
Figure 9 depicts a fairly good fit of the regression curve to the data.

The addition of the polynomial variable SDp^2 does not significantly improve the model. An R-square of .7065 was achieved, which is an increase of .027 points. This is not a significant increase. A scatterplot for this model $y_3 = \frac{a}{SDp_1} + \frac{a}{SDp_2^2} + b$ portrays the fit of the regression curve to the data (see Figure 10).

Again, this model exhibits a good fit of the regression curve to the data; however, it is not a significantly better fit than the previous model. Additional polynomials were not added to this model since the inclusion of the variable SDp^2 did not strengthen the overall significance of the original model.

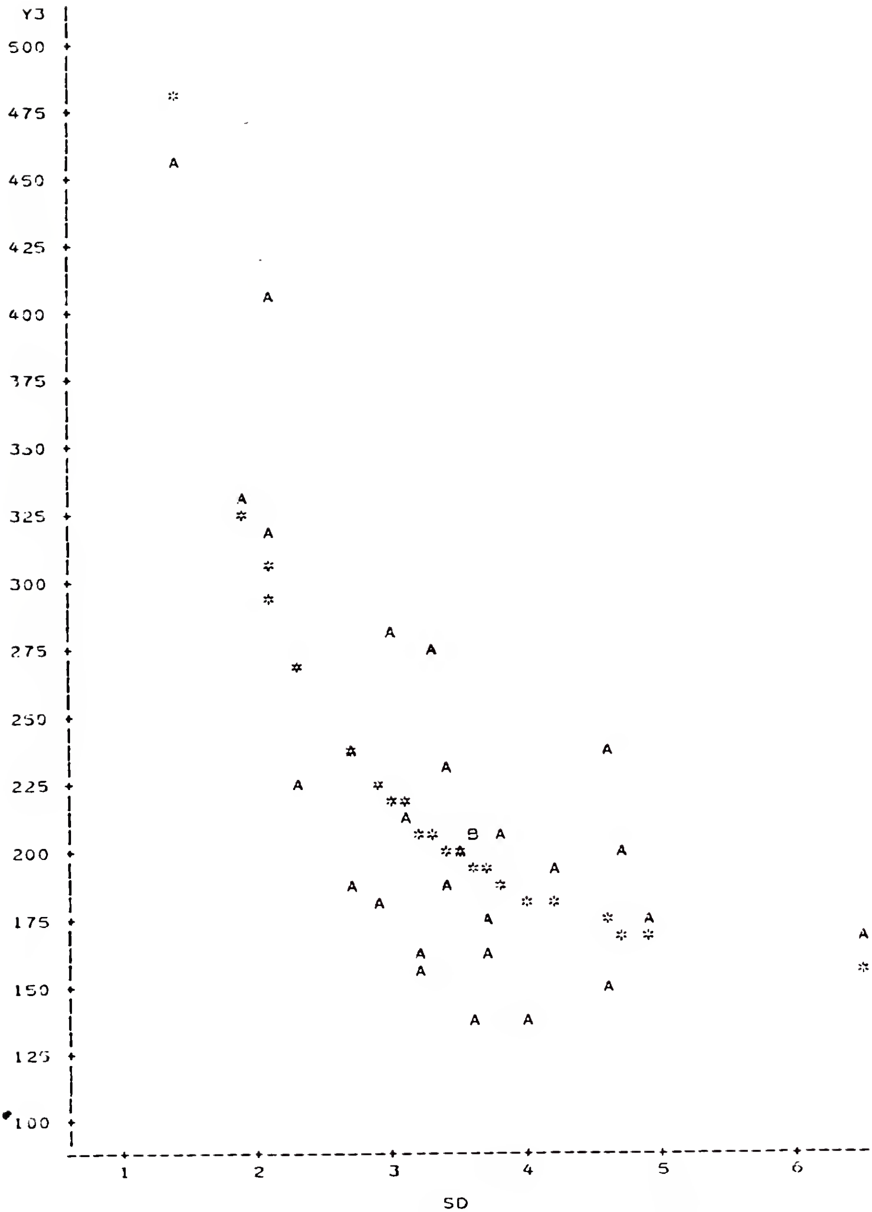
Comparisons of the Two Models Used with Regular Students Transported

The best model for predicting cost per regular student transported was one which incorporated polynomial variables into the model $y_3 = a(SD_1) + a(SD_2^2) + a(SD_3^3) + b$. The model yielded an R-square of .7355, meaning that approximately 74 percent of the transportation costs for regular students can be explained by the variable, density. These results indicate that even when exceptional students are removed from the model, density is still a good predictor of actual costs incurred by pupil transportation programs where regular students are concerned.



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 4 observations hidden.

Figure 9. Plot of $y_3 = \frac{a}{SDp^I} + b$



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 7 observations hidden.

Figure 10. Plot of $y_3 = \frac{a}{SDp_1^1} + \frac{a}{SDP_2^2} + b$

Testing of the Two Models with Exceptional Students Only

The two models were applied to a population comprised of exceptional students transported. In order to discern whether the dependent variable, cost per exceptional student transported, could be predicted from the independent variable, density, both measures had to be derived to fit the characteristics of this population.

Cost per exceptional student transported for each district was calculated by summing the three main cost figures attributed to exceptional student transportation: (a) fuel costs, (b) maintenance costs, and (c) salaries of bus drivers and aides. The total cost figure for each district was then divided by the number of exceptional students transported on school buses used exclusively for exceptional student transportation.

A density index was calculated for each of the sample school districts. The formula for calculating the density index calls for dividing the number of students transported by the miles traveled. In order to promote efficiency, miles traveled does not include total miles traveled by every bus. Instead, the miles are divided into two categories, "miles with students" and "miles without students."

Total "miles with students" is multiplied by one-half; total "miles without students" is multiplied by one-fourth. The sum of these two measures equals miles traveled.

Mileage collected from the sample school districts for exceptional student transportation was reported as total mileage. Therefore, it was necessary to determine which portion of the mileage was mileage traveled with students and which was mileage traveled without students. Mileage figures for the population "all students transported" were examined to discern which proportion of the total mileage was mileage with students and which was without students.

The total mileage for all students transported for all districts was 554,832.4. Of this amount, 389,595.5 miles were miles with students and 165,236.9 miles were miles accumulated without students (Florida Department of Education, Finance Section, 1983). By dividing each of these figures by the total mileage, it was determined that .7021 or 70 percent of the total mileage was mileage with students, while .2979 or 30 percent of the total mileage was mileage without students.

Consequently, these two figures--.7021 and .2979--were used in calculating "miles with students" and "miles without students" for exceptional student transportation. The following diagram describes the procedure involved in

computing an exceptional student density index for each county:

1. (district exceptional student mileage x .7021).5 =

   exceptional student mileage with students.

   (district exceptional student mileage x .2979).25 =

   exceptional student mileage without students.

2. miles with

   +miles without

   total exceptional student mileage.

3. $\frac{\text{exceptional students transported}}{\text{mileage traveled}} = \text{exceptional student density index.}$

The cost per exceptional pupil transported and density index for each of the sample school districts are presented in Table 8, along with a discussion of the cost data in the text.

Discussion of Cost Figures for Exceptional Students

As illustrated by Table 8, the cost per exceptional student transported varies significantly from district to district. Baker County spends on the average $3609.86 to transport each exceptional student whose handicap requires transportation other than the usual kind provided by regular district buses. Hamilton, on the other hand, expends $138.60 per exceptional student transported.

Table 8. Cost per Exceptional Student Transported and Density Index for Sample School Districts for the 1982-83 School Year

School district	Cost per exceptional student transported	Density index for exceptional students
Alachua	$ 664.94	.46
Baker	3,609.86	.15
Bay	564.20	.61
Brevard	1,278.98	.41
Broward	1,105.00	.56
Calhoun	531.20	.53
Charlotte	1,148.81	.24
Clay	2,125.80	.13
Dade	763.52	.55
DeSoto	1,724.96	.25
Duval	676.80	.35
Glades	2,975.70	.13
Gulf	1,288.53	.14
Hamilton	138.60	2.56
Hardee	1,082.26	.22
Hendry	854.08	.49

Table 8 (continued)

School district	Cost per exceptional student transported	Density index for exceptional students
Highlands	653.47	.16
Indian River	3,106.25	.23
Jefferson	326.20	.62
Madison	1,114.02	.27
Okaloosa	1,531.41	.27
Okeechobee	1,181.01	.14
Orange	1,899.68	.12
Pasco	2,125.04	.34
Polk	1,350.00	.44
Putnam	550.09	.39
Sumter	1,100.71	.20
Suwannee	647.60	.22
Taylor	1,423.14	.22

In order to ascertain which factors contribute to exceptional student transportation costs in specific districts, a breakdown of total expenditures for sample school districts was analyzed. (See Appendix H.) Extremely high or low costs were reverified for accuracy and possible explanations for such disparities were supplied.

Union County School District was ranked highest in money spent on exceptional student transportation per student. Union County transported only one student by special transportation services at a cost of $15,610.15. A van was used to transport the student because of the presence of a physical handicap which necessitated the use of a wheelchair. Since Union County's costs were much higher than the rest of the school district's costs, Union County was excluded from the sample used to test the models. If Union County School District remained in the sample, results would be so badly skewed that a realistic picture of overall findings would be clouded.

Baker County with a cost per exceptional student transported figure of $3,609.86 ranked second highest among counties in the amount of transportation dollars spent per exceptional student. Baker School District transported 14 students with various handicaps to programs in Duval County

located 30 miles away. These programs are not centrally located, but instead are spread throughout the City of Jacksonville. One program which is attended by a deaf student is located in Jacksonville Beach.

Two buses are used to carry the 14 students; one is a 48-passenger bus and the other has the capacity to hold 19 students. Two bus drivers are employed and also two aides. The total expenditure on exceptional student transportation for Baker County for the 1982-83 school year was approximately $60,000. Of this expenditure, $9,000 paid for fuel and maintenance. Salaries for two bus drivers and two aides accounted for $40,000. This salary figure is relatively high when compared with salary figures for counties of similar student membership size.

Indian River ranked third highest in the number of transportation dollars spent per exceptional student, with a cost figure of $3,106.25. Transportation personnel maintained that sparsity was the main cause of high exceptional student transportation costs. In comparing density indices for exceptional students of Indian River with Charlotte, a school district of similar student population size, it was determined that Charlotte had a density index of .24, while Indian River's density index was slightly smaller: .23.

Charlotte transports 32 exceptional students a total of 301.2 miles; Indian River transports approximately twice as many students, twice as far: 61 students, 606.2 miles. The total cost of fuel for Indian River was extremely high: $141,008.50. In contrast, Charlotte County schools expended $11,587 on fuel.

Glades School District had the fourth highest cost per exceptional student transported at $2,975.00. Density appears to be the main reason for such high costs. Glades County is a sparsely populated area, registering the smallest student population for all counties in Florida: 863.56 students. There are only four students transported by exceptional student transportation services. According to the transportation supervisor, these students live in "all four corners of the county" (Bass, personal communication, November, 1983). The density index for exceptional students for Glades School District is .13.

Cost breakdowns furnished by two school districts showed very low cost per exceptional student transported figures. During the 1982-83 school year, Hamilton County schools spent $138.60 per exceptional student transported; and Jefferson County schools spent $326.20. The reason behind low cost figures was similar for each county.

Hamilton County transports 12 students to a tri-county center 11 miles outside the town of Jasper, Florida. All 12 students are picked up in Jasper. In Jefferson, 28 exceptional students are picked up by special transportation services within the city limits of Monticello. Exceptional students outside city limits, in this case 18 students, travel on regular school buses to a designated area. The original special education bus then picks up the 18 extra students and proceeds to exceptional education programs in Tallahassee, located in the neighboring county of Leon.

Alternative Linear Regression Model

After deriving the cost per exceptional student transported and the density index for each of the 30 sample school districts, the two models were tested with the exceptional student population. First, the alternative linear regression model y = a(DISPE) + b was tested, with cost per exceptional student transported being the dependent variable y, and the density index for exceptional students (DISPE) acting as the independent variable. For this model an R-square of .1921 was attained. With an R-square of .1921, this model is a weak model for predicting costs of exceptional student transportation. Density explains only 19 percent of the cost. A scatterplot for this model, as

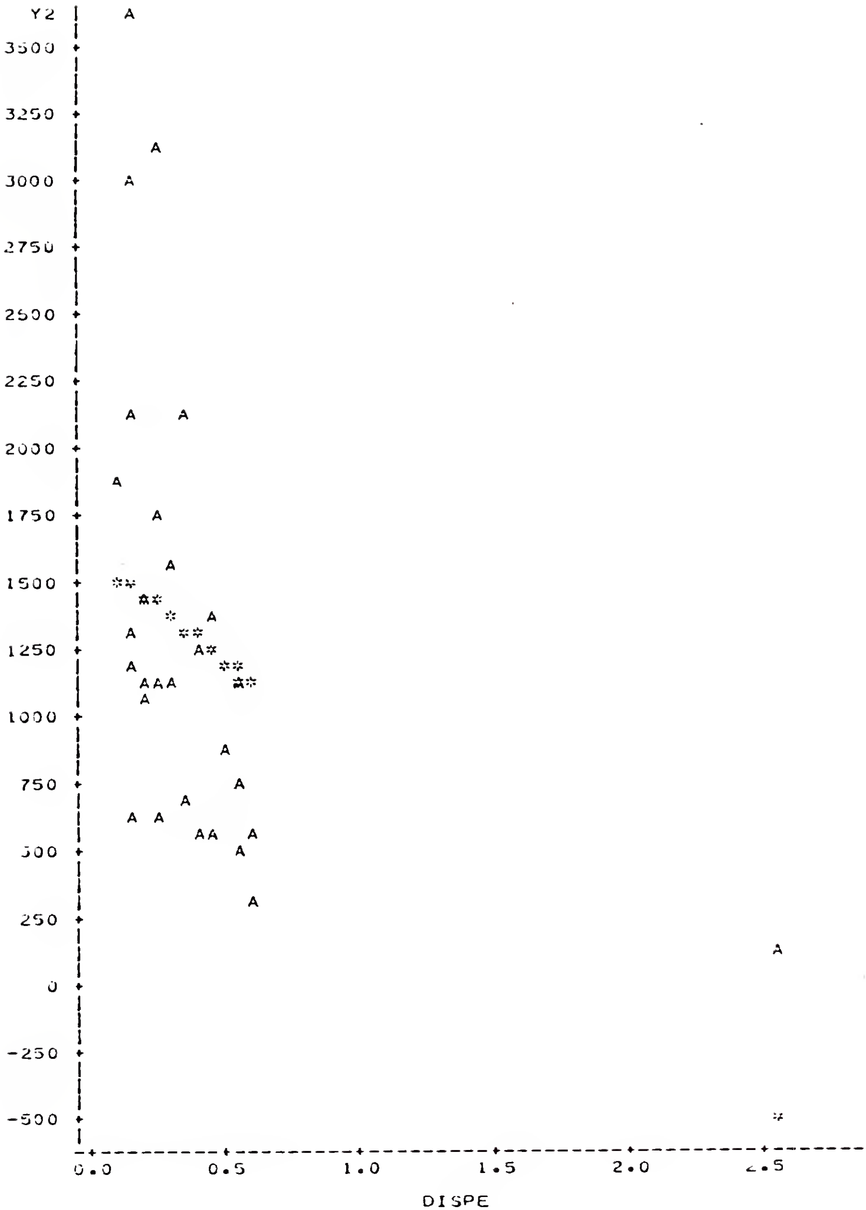
depicted in Figure 11, displays the inadequate fit of the regression line to the data.

When the polynomial variable $DISPE^2$ was entered in the model, the R-square doubled, increasing from .1921 to .3622. The scatterplot depicting the relationship between cost per exceptional student transported and density, as shown in Figure 12, is a better fit than the previous model's; however- it still is not a good fit. With this model, $y_2 = a(DISPE_1) + a(DISPE_2^2) + b$, approximately 36 percent of the costs of exceptional student transportation can be explained by density.

The addition of a second polynomial variable, $DISPE^3$, to the model does not prove to make a significant difference. For the model $y_2 = a(DISPE_1) + a(DISPE_2^2) + a(DISPE_3^3) + b$, an R-square of .3648 was achieved. This is an increase of .002 points over the previous model, which is not a significant increase. A scatterplot for this model (see Figure 13) reveals an almost identical fit of the regression line to the data as achieved in Figure 12.

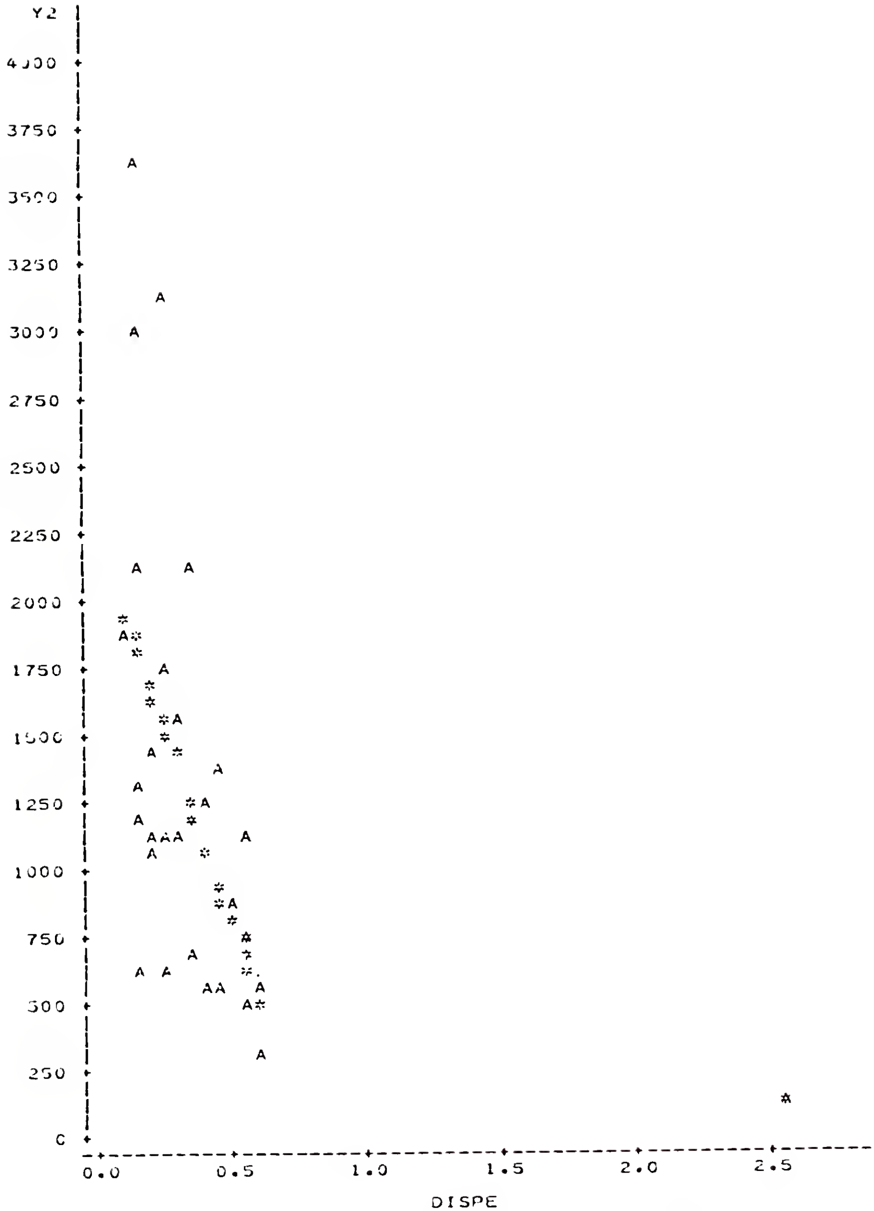
Florida Transportation Linear Regression Model

When the model used to fund pupil transportation programs in Florida was tested with the exceptional student



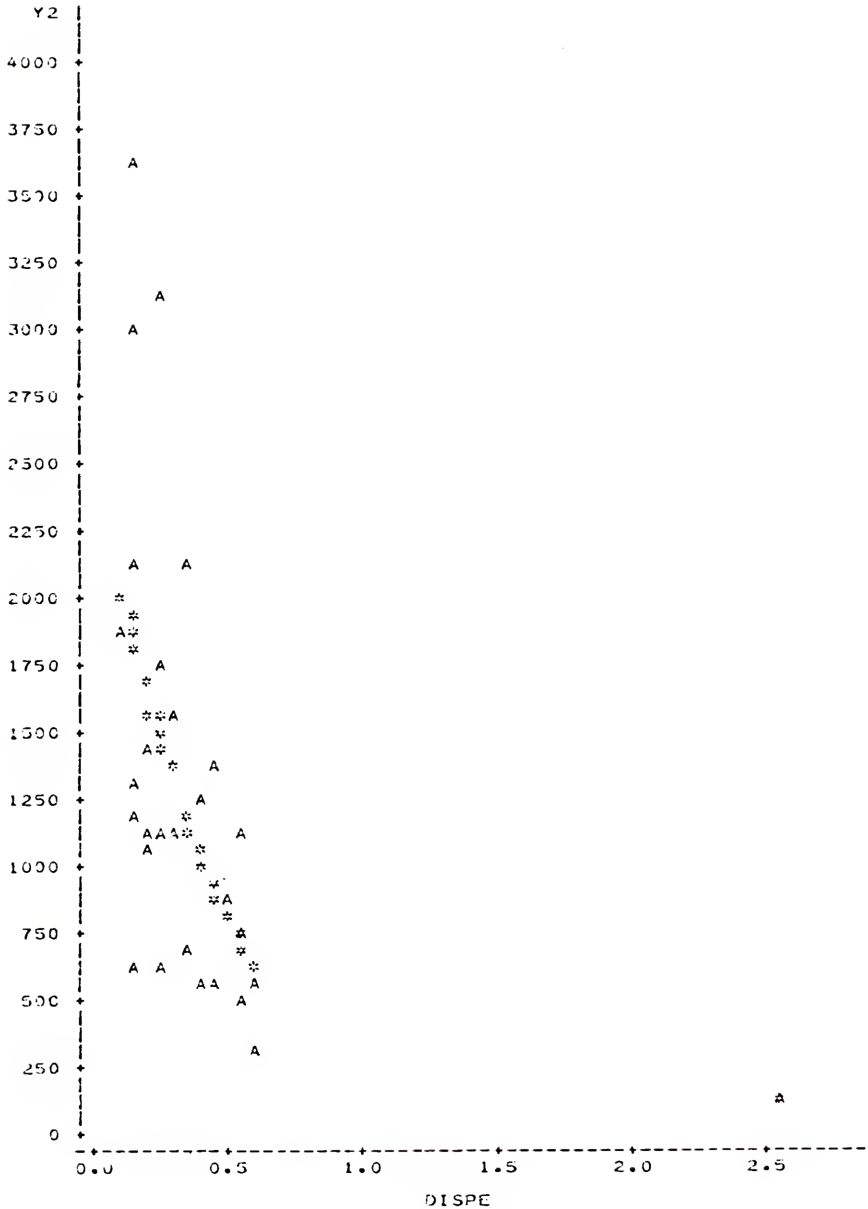
Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 16 observations hidden.

Figure 11. Plot of y_2 = a(DISPE) + b



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 10 observations hidden.

Figure 12. Plot of $y_2 = a(DISPE_1) + a(DISPE_2^2) + b$

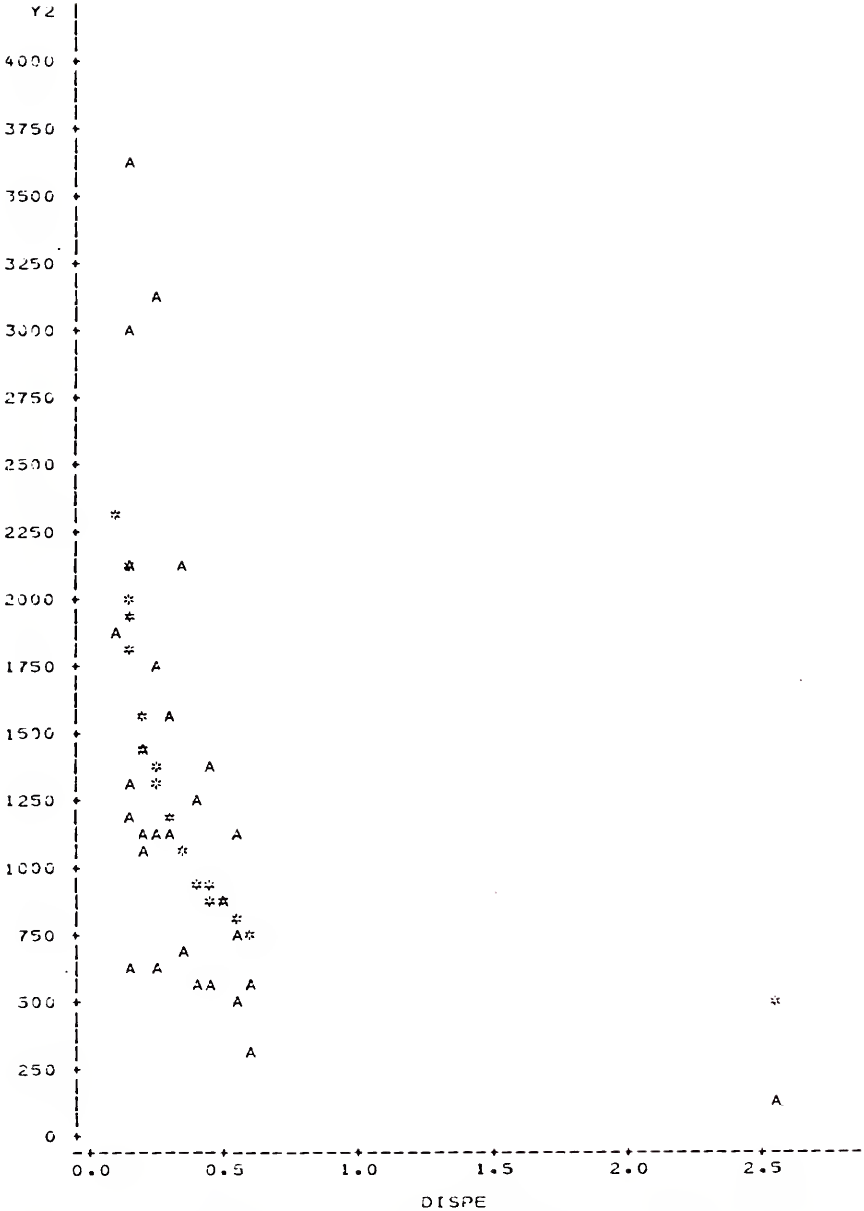


Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 8 observations hidden.

Figure 13. Plot of $y_2 = a(DISPE_1) + a(DISPE_2^2) + a(DISPE_3^3) + b$

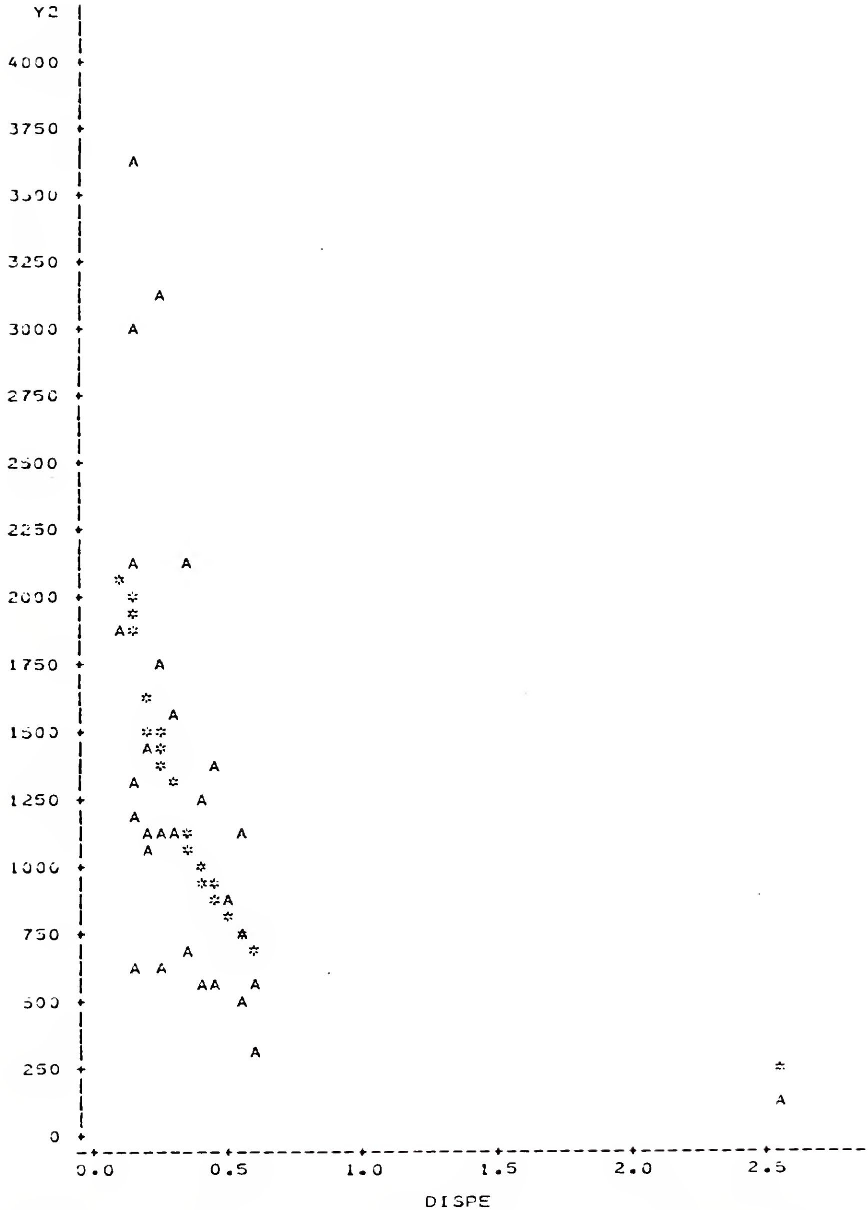
population, the R-square was reduced slightly. With the model $y_2 = \frac{a}{DI^1} + b$, in which y is the cost per exceptional student transported and DI^1 is the independent variable, density, an R-square of .3514 was obtained. This change in R-square indicates that this model also is not a good model for predicting the cost of exceptional student transportation. Density explains only 35 percent of the cost. A scatterplot for this model further points out the lack of fit between the regression curve and the data (see Figure 14.)

When the polynomial variable DI^2 is added to the original model, the R-square is not significantly increased. An R-square of .3630 was obtained which was an increase of .0116 over the previous model's R-square. A scatterplot depicting the relationship between the cost per exceptional student transported and density is given in Figure 15. It can be seen that there exists a poor fit of the regression curve to the data. The scatterplot for this model is not a significant improvement over the scatterplot for the previous model, as shown in Figure 14. Since the inclusion of the variable DI^2 did not contribute to the significance of the model, no additional polynomial variables were tested.



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 11 observations hidden.

Figure 14. Plot of $y_2 = \frac{a}{DI^I} + b$



Legend: A=1 observation, B=2 observations, etc. Symbol used is *.
Note: 9 observations hidden.

Figure 15. Plot of $y_2 = \frac{a}{DI_1^1} + \frac{a}{DI_2^2} + b$

Comparison of the Two Models Tested with Exceptional Students Transported

Neither of the two models tested were very strong models for predicting the cost of exceptional student transportation. The alternative linear regression model $y_2 =$ a(DISPE) + b yielded an R-square of .1921. Although the addition of a polynomial variable $y_2 = a(DISPE_1) + a(DISPE_2^2) + b$ increased the R-square to .3622, this still indicates that density explains only 36 percent of the cost of exceptional student transportation and by itself is not a strong variable for predicting costs. A simple correlation measuring the strength of the relationship between cost per exceptional student transported and density supported this conclusion. There was a correlation between the two variables of .43, indicating a weak relationship (see Table 9).

Density and its Effect Upon Pupil Transportation Costs

Density was found to be the best predictor of actual costs for all students transported. This was not surprising since previous research in school transportation has maintained this to be true. The best model for predicting cost per student transported was the current Florida pupil transportation formula $y_2 = \frac{a}{x} + b$, which obtained an R-square of .6554. Although the alternative linear regression model

Table 9. Simple Correlations Between Dependent Variables y_1, y_2, y_3, and Independent Variables x, SD, and DISPE

	y1[a]	y2[b]	y3[c]	x[d]	SD[e]	DISPE[f]
y_1	1.00000	0.10464	0.98496	-0.73451	-0.57528	0.40114
	0.0000	0.5891	0.0001	0.0001	0.0011	0.0310
y_2	0.10464	1.00000	0.01780	0.09599	0.10131	-0.43830
	0.5891	0.0000	0.9270	0.6204	0.6010	0.0174
y_3	0.98496	0.01780	1.00000	-0.76629	-0.64799	0.42557
	0.0001	0.9270	0.0000	0.0001	0.0001	0.0214
x	-0.73451	0.09599	-0.76629	1.00000	0.83206	-0.22139
	0.0001	0.6204	0.0001	0.0000	0.0001	0.2484
SD	-0.57528	0.10131	-0.64799	0.83206	1.00000	-0.24789
	0.0011	0.6010	0.0001	0.0001	0.0000	0.1948
DISPE	0.40114	-0.43830	0.42557	-0.22139	-0.24789	1.00000
	0.0310	0.0174	0.0214	0.2484	0.1948	0.0000

[a]Cost per student transported.
[b]Cost per exceptional student transported.
[c]Cost per regular student transported.
[d]Density index for all students.
[e]Density index for regular students.
[f]Density index for exceptional students.

$y_1 = ax_1 + ax_2^2 + b$ attained a slightly higher R-square, .6745, this increase is not sufficient reason for utilizing the model. The current Florida pupil transportation formula model is more parsimonious than the alternative linear regression model and for this reason is easier to use in calculating state per pupil cost figures for individual school districts.

Density and Regular Students

When the models were tested with regular students only, an R-square of .7355 was obtained with the model $y_3 = a(SD_1) + a(SD_2^2) + a(SD_3^3) + b$. This indicates that density is still a good predictor of actual transportation costs even when exceptional students are removed from the model. Testing the Florida pupil transportation formula model with regular students transported achieved similar results. An R-square of .6795 was obtained with the model $y_3 = \frac{a}{SD} + b$. These results indicate that density is a good predictor of regular student transportation costs.

Simple correlations were run to determine the strength of the relationship between different pairs of variables. As can be seen in Table 9, there is a moderate correlation between cost per regular student transported (y_3) and density for regular students (SD). There is an even stronger relationship between cost per regular student

transported and density for all students transported (x). These correlations indicate that there exists a strong relationship between transportation costs for regular students and density.

The correlation between cost per all students transported (y_1) and cost per regular student transported (y_3) also evidences a strong relationship. The correlation depicting the relationship between these two variables is .98, indicating that there is a very strong relationship between the two cost figures (see Table 9).

Density and Exceptional Students

Density is not a good predictor of exceptional student transportation costs. When regular students are taken out of the model, the R-square is significantly reduced in both of the models tested. The highest R-square obtained was .3622 using the model $y_2 = a(DISPE_1) + a(DISPE_2^2) + b$, where y_2 was the cost per exceptional student transported and DISPE was the density index for exceptional students. With this model 36 percent of the cost of exceptional student transportation is explained by density.

As can be seen in Table 9, when simple correlations are obtained, the correlation between y_2 (cost per exceptional student transported) and DISPE (density) is .43.

There exists practically no relationship at all between y_2 and x (density for all students): .09. These correlations indicate that there is a weak relationship existing between transportation costs for exceptional students and density.

A similar situation exists in the relationship between cost per all students transported (y_1) and cost per exceptional student transported (y_2). The simple correlation depicting the relationship between these two variables is .10, which indicates that a very weak relationship exists. The transportation costs for exceptional students, then, are not related to the overall costs of pupil transportation.

A possible factor responsible for the variation in exceptional student transportation costs among school districts might be inefficiency in methods of managing and operating exceptional student transportation programs. This is borne out by individual cost figures for exceptional student transportation which were collected from the school districts.

The high variability in cost figures for individual counties suggests that some districts operate more efficiently than others. For example, both Indian River and Highlands have approximately the same number of students

to transport. Indian River transports 61 exceptional students and Highlands transports 64. Both school districts have nearly identical density indices for all students transported; Indian River's density index is 3.07 and Highlands' is 3.09. A density index for exceptional students transported was calculated for each school district. Indian River's density index was calculated to be .23, while Highlands' density index was a much smaller figure: .16.

Normally, these density indices would indicated that the Highlands exceptional student transportation services could be expected to generate much higher expenses than those of Indian River School District, since the higher the density index the lower the cost. However, in this case, Indian River pays an average cost of $3,106.25 per exceptional student transported, while Highlands County schools pay $653.47. The difference in cost figures might indicate inefficiency within Indian River's program.

A more graphic example of inefficiency is the situation existing in Union School District. The cost to transport one student to the necessary exceptional education program was reported as $15,610.15. A minibus was used to transport the student. The use of the minibus incurred the following

changes: (a) fuel--$5,241.00, (b) maintenance--$4,368.00, and (c) salary of bus driver--$6,001.15. This cost to transport one student is $600 higher than the total cost of the exceptional student transportation services of Jefferson County schools. In Jefferson County, 46 students were transported at a cost of $326.20 per exceptional student.

In conclusion, density is not a strong predictor of actual transportation costs incurred by districts in transporting exceptional students. Variation in costs among school districts appears to be the product of inefficient methods utilized in operating exceptional student transportation programs.

The Florida Pupil Transportation Formula and the Funding of Handicapped Transportation

The current Florida pupil transportation formula is an efficiency formula based upon density, meaning that the cost per student transported by a district is directly related to the number of students transported and the total allowable miles traveled. Districts which are most efficient in managing their pupil transportation programs are rewarded by having lower costs which, in turn, enables such districts to expend more state dollars on transportation than local revenues.

It has been maintained by state pupil transportation managers that handicapped transportation costs are adequately funded by the Florida pupil transportation formula. This argument is based upon the concept that the costs of handicapped transportation are also related to density; i.e., if a school district is transporting fewer handicapped students additional miles, then a sparsity factor exists which will be corrected by utilizing the density index.

The results of the present study show that handicapped student transportation costs are not related to density. Utilizing the best model, only 36 percent of the cost per handicapped student transported can be explained in terms of density. Therefore, the present transportation formula does not appear to be adequately addressing the needs of handicapped transportation in terms of funding.

A second finding of the present study determined that inefficiency in methods used to operate exceptional student transportation programs might be a chief factor in the variation of costs existing among districts. A breakdown of reported costs for the 30 sample school districts during the 1982-83 school year provided information with which to compare cost figures for different counties.

Possible areas of inefficiency determined were (a) excessive fuel costs, (b) excessive salaries, and (c) use of large buses to transport a few students. It can be reasoned that if these areas of inefficiency were corrected, less variation in handicapped transportation cost figures would exist among school districts. With less variation in costs, the utilization of the current Florida pupil transportation formula, along with a weighting factor for handicapped student transportation costs, might be a viable alternative method for more accurately funding handicapped student transportation. Currently, however, the application of a weighting factor would be impossible in view of the wide diversity of handicapped transportation cost figures existing among school districts.

Summary

In this chapter the two models developed in Chapter IV were tested with three different populations: (a) all students transported, (b) regular students transported, and (c) exceptional students transported. Results obtained indicate that density is a good predictor of actual costs incurred by district pupil transportation when all students are accounted for in the model. An R-square of .6554 suggests that density can explain approximately 66 percent

of the cost of per pupil transported of the individual districts. The best model for predicting pupil transportation costs is the current Florida pupil transportation formula $y_1 = \frac{a}{x} + b$.

Density is still a good predictor of cost per regular pupil transported when exceptional students are removed from the model. With the model $y_3 = a(SD_1) + a(SD_2^2) + a(SD_3^3) + b$, an R-square of .7355 was obtained, suggesting that density can explain 74 percent of the cost per regular pupil transported.

Simple correlations obtained similar results. The correlation between y_1 (cost per student transported) and y_3 (cost per regular student transported) was high: .98, which suggests that there is a strong relationship between the two costs. This supports the finding that density is a good predictor of both costs.

Exceptional student transportation experienced opposite results from those obtained with all students transported and regular students transported. Density was determined to be a poor predictor of exceptional student transportation costs. The best model for predicting these costs, using density yielded an R-square of .3622, meaning that only 36 percent of the cost per exceptional student transported can be explained in terms of density. Evidence that inefficiency

might be partly responsible for variation in handicapped transportation costs among districts can be discerned from studying the breakdown of costs for exceptional student transportation. Recommendations in Chapter VI will address this issue.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

Administration and control of pupil transportation has been under the auspices of the public school systems since the early 1900s. In recent years, the scope of the services rendered by pupil transportation programs has been enlarged in order to accommodate a variety of student populations. Handicapped students are one of these groups requiring pupil transportation.

Because of their special needs, handicapped students cannot always be transported on regular school buses. Handicapped students often require:

1. specially equipped buses for carrying wheelchairs, stretchers, and students who need to be restrained while traveling;

2. different routing and scheduling for door-to-door pick-up and delivery;

3. aides to accompany students with severe handicaps to and from school; and

4. transportation to programs located a considerable distance from the student's home.

The cost of exceptional student transportation escalates with the degree of severity of the handicap. Many exceptional students are transported on regular school buses with no additional cost to the school district. However, cost per pupil for students transported on special buses is more expensive and in some instances extraordinarily high.

The present study was undertaken to determine (a) the cost of exceptional student transportation services for districts in Florida and (b) whether the existing formula adequately funded these district costs. A sample of 30 school districts was used as the data base for the study. School districts were chosen according to size of student membership. Districts selected were representative of districts of similar size. The following data were gathered from each of the counties for the 1982-83 school year: (a) mileage for regular and exceptional students, (b) total transported membership for both regular and exceptional students, and (c) cost figures for fuel, maintenance, and salaries on all exceptional student buses. From these data density indices were computed for both regular and exceptional students, as well as cost per pupil transported for the two populations.

The current Florida formula was then tested using three different populations: (a) all students transported,

(b) regular students transported, and (c) exceptional students transported. An alternative linear regression model also was tested. Polynomial variables were added to each of the original models. Density, which a review of related literature revealed is the single best predictor of transportation costs, was the independent variable. Cost per pupil transported for each of the three populations became the dependent variable.

The following results were achieved:

1. With the population all students transported, density is the single best predictor of cost per pupil. An R-square of the model $y_1 = \frac{a}{x} + b$ explained 66 percent of the costs of per pupil transported. This model is the one currently used by the state of Florida to fund pupil transportation.

2. When exceptional students were removed from the model and only regular students remained, density still was a strong predictor, being able to explain 74 percent of the cost per pupil transported.

3. A simple correlation measuring the relationship between cost per regular student transported and density was high: .83. Similarly a correlation of .98 between cost per pupil transported (y_1) and cost per regular pupil

transported (y_3) indicates that there is a strong relationship between transportation costs for these two populations.

In contrast, y_2 (cost per exceptional student transported) explained only one percent of the costs incurred in transporting all students.

4. Density is a poor predictor in explaining exceptional student costs. The best model, in which density was the independent variable and cost per exceptional student transported was the dependent variable, yielded an R-square of .36. A simple correlation measuring the relationship between density and cost per exceptional student transported was very low: .43.

5. Inefficiency in the operation and management of handicapped student transportation programs might be a chief factor in the variation of costs for handicapped transportation among school districts. Cost figures for several school districts indicate that expenditures for fuel, salaries and maintenance exceed those of similar districts.

Pupil transportation in Florida, in relation to the expense of exceptional student transportation, needs to be investigated further. The present study was limited in its

research of the problem due to the inaccessibility of transportation records at the district level. Results indicate that costs for exceptional student transportation differ sufficiently enough from county to county to warrant a state-sponsored study. The most recent state-sponsored study was conducted in 1977 and involved 15 school districts. Since that time Florida's school population of exceptional students has increased significantly, with the largest increases occurring in the profoundly handicapped category. Yet, the actual cost of exceptional student transportation in the state of Florida is unknown. The present study was able to determine cost figures for 30 of the 67 school districts in Florida.

Further research of exceptional student transportation services is recommended:

1. to determine the exact cost of exceptional student transportation to the state of Florida;

2. to investigate the feasibility of utilizing a variety of alternative methods for transporting handicapped students, i.e., taxi services, parent-provided transportation, rather than relying solely upon the use of district buses;

3. to study management methods practiced by districts in routing, scheduling, and assigning handicapped students to buses in an effort to establish state-wide guidelines for promoting efficiency in the transportation of exceptional students; and

4. to investigate the adoption of a weighting factor for handicapped student transportation, similar to that used in other states, as a means of alleviating the burden placed upon school districts in funding handicapped transportation through the use of a density formula, when costs engendered by handicapped transportation are not explained by density.

APPENDICES

APPENDIX A

LETTER TO STATE SCHOOL FINANCE DIRECTORS

INFORMATION REQUESTED:

1. Method used by your state to finance transportation of special education students.

2. If transportation funds are distributed on a formula basis, please send exact calculation information.

3. Actual cost incurred in transporting special education students in your state.

4. Types of handicapped students transported by vehicles serving only the handicapped:

physically handicapped	deaf
educable mentally retarded	blind
trainable mentally retarded	multiplihandicapped
severe/profound mentally retarded	learning disabled
emotionally disturbed	socially maladjusted
	others

5. Please include any studies or data by which costs of transportation were determined.

APPENDIX B

METHODS USED BY THE 50 STATES TO FUND EXCEPTIONAL STUDENT TRANSPORTATION

STATE	FUNDING METHOD
Alabama	No information.
Alaska	Appropriation from State General Fund; Districts reimbursed for 100% cost of exceptional student transportation when funds available.
Arizona	Transportation is one component of a block grant funding all educational programs. Exceptional students funded on same per mile/per student basis as regular students transported.
Arkansas	Density formula used for calculating costs for regular pupil transportation. Additional weighting factors used for exceptional students transported.
California	Reimbursement for most costs involved in transporting exceptional students.
Colorado	No information.
Connecticut	No information.
Delaware	Reimbursement on allowable costs.
Florida	Density formula--no distinction between regular and exceptional student transportation costs.
Georgia	Funds for exceptional student transportation costs appropriated on the basis of the actual costs.
Hawaii	By state appropriation--funds are provided according to bid prices.
Idaho	Reimbursement at 85% of allowable costs.
Illinois	Reimbursement at 4/5 of allowable costs.

APPENDIX B (CONTINUED)

STATE	FUNDING METHOD
Indiana	Density formula used to determine per pupil transported cost, 80% of additional cost incurred transporting exceptional students is reimbursed.
Iowa	Handicapped programs are categorized according to severity and given weighting factors. District expenditure per pupil is multiplied by the weighting factor. Transportation is included within this total cost.
Kansas	State statutes authorize that 80% of exceptional student transportation be reimbursed.
Kentucky	Area density formula for cost per pupil transported. Weighting factor of 5.0 for exceptional students transported.
Louisiana	Districts reimbursed 21¢ per mile one way for each exceptional student transported.
Maine	100% of transportation costs reimbursed.
Maryland	No distinction between regular and exceptional students transported. All transportation funded by a grant.
Massachusetts	No information.
Michigan	Formula reimburses 75% of the costs of exceptional student transportation; actual appropriation funds 50% of costs.
Minnesota	No information.
Mississippi	Formula used to determine all pupil transportation funding--no distinction is made between regular and exceptional students.

APPENDIX B (CONTINUED)

STATE	FUNDING METHOD
Missouri	Linear density formula used to compute basic cost per pupil transported; 80% of that cost is funded by state, plus 80% of additional costs incurred when transporting exceptional students.
Montana	State pays 2/3 of cost per pupil transported; buses that use wheelchair lifts are provided a total reimbursement.
Nebraska	Transportation costs for exceptional students who travel on special buses are paid out of special educational funds. The majority of exceptional students are transported by parents, who are paid 18¢ per mile.
Nevada	Funds for transportation are included as part of the state's foundation program. These funds average $110 per student transported. There is no distinction between regular and exceptional students transported.
New Hampshire	No state support for transportation.
New Jersey	All students funded on basis of density formula which funds 90% of every route.
New Mexico	Formula based on reimbursing allowable costs; extra funding for aides.
New York	State reimburses 90% of the cost of exceptional students; sometimes 100%.
North Carolina	Density formula used for all student transportation.
North Dakota	Reimbursement by mileage and bus capacity for all students transported; any costs over the allowed amount incurred by exceptional students is reimbursed by the Special Education Division up to 60% of the cost.

APPENDIX B (CONTINUED)

STATE	FUNDING METHOD
Ohio	Exceptional students' transportation reimbursed \$3.00 per day per student and 1/2 of the actual cost in excess of \$3.00 per day.
Oklahoma	No special provisions for exceptional student transportation; all students funded by density formula.
Oregon	No information.
Pennsylvania	Reimburses allowable costs for exceptional student transportation.
Rhode Island	Transportation funds for exceptional students are part of program costs. Each district reimbursed 100% for handicapped, provided they do not exceed 110% cost of regular student.
South Carolina	School buses are owned and operated by State Board of Education. Funds appropriated for transportation to local districts for routing supervision.
South Dakota	Formula funded by which 50% of the net cost of transportation is reimbursed, but not more than 35¢ per mile.
Tennessee	Funded through funds allocated for the education of the handicapped.
Texas	Mileage reimbursed not to exceed 95¢ per mile; if additional funds are needed, they must come out of local monies.
Utah	Density formula which funds 100% of approved costs.
Vermont	No state funds available for transportation during the 1982-83 school year; so funded locally.

APPENDIX B (CONTINUED)

STATE	FUNDING METHOD
Virginia	40% of reimbursement based upon miles traveled; 40% of reimbursement based upon number of students transported; and 20% of fund is distributed on the basis of number of school buses used.
Washington	Weighting factors used in funding exceptional student transportation 60% of the costs are reimbursable.
West Virginia	No information.
Wisconsin	70% of transportation costs of exceptional students reimbursable by state statute; only 66% reimbursed during 1982-83.
Wyoming	Exceptional student transportation costs 100% reimbursed.

APPENDIX C

CALCULATION OF THE FLORIDA PUPIL TRANSPORTATION FORMULA

Vehicle miles with students	Vehicle miles without students	Vehicle miles nonessential	Total membership transported students
6,000	2,500	1,500	10,500

Step 1: Compute allowable vehicle miles

$$\begin{array}{r} 6000 \\ \underline{x.50} \\ 3000 \end{array} + \begin{array}{r} 2500 \\ \underline{x.25} \\ 625 \end{array} = 3625 \text{ miles}$$

Step 2: Compute density index

$$\frac{10500}{3625} = 2.89 \text{ (density index)}$$

Step 3: Compute state allocation with formula

$$\text{Cost per student} = \frac{386.2385^{a}}{2.89} + 42.50283^{a}$$

Cost per student = \$133.64 + 42.50283

Cost per student = \$176.15

10,500 students x \$176.15 = \$1,849,568.20

State unprorated allocation = \$1,849,568.20

*Does not enter into this section of the calculations.

[a]Constants set annually by the State Department of Education.

APPENDIX D

THE EFFECT OF THE DENSITY INDEX UPON STATE ALLOCATION

District A

Vehicle miles with students	Vehicle miles without students	Vehicle miles nonessential*	Total membership transported students
6,000	2,500	1,500	10,500

$$\begin{array}{r} 6000 \\ \underline{x.50} \\ 3000 \end{array} + \begin{array}{r} 2500 \\ \underline{x.25} \\ 625 \end{array} = 3625 \text{ miles}$$

$$\frac{10500}{3625} = 2.89 \text{ (density index)}$$

$$\text{Cost per student} = \frac{386.2385^{a}}{2.89} + 42.50283^{a}$$

$$\text{Cost per student} = 133.64 + 42.50283$$

District A's cost per student = \$176.15

*Does not enter into this section of the calculations.

[a] Constants set annually by the State Department of Education.

APPENDIX D (CONTINUED)

District B

Vehicle miles with students	Vehicle miles without students	Vehicle miles nonessential*	Total membership transported students
10,000	3,000	2,225	10,500

$$\begin{array}{r} 10000 \\ \times .50 \\ \hline 5000 \end{array} + \begin{array}{r} 3000 \\ \times .25 \\ \hline 750 \end{array} = 5750 \text{ miles}$$

$$\frac{10500}{5750} = 1.83 \text{ (density index)}$$

$$\text{Cost per student} = \frac{386.2385^{a}}{1.83} + 42.50283^{a}$$

$$\text{Cost per student} = \$211.06 + 42.50283$$

District B's cost per student = $253.56

*Does not enter into this section of the calculations.

[a]Constants set annually by the State Department of Education.

APPENDIX E

THE EFFECT OF INEFFICIENCY UPON COST OF DISTRICT PUPIL TRANSPORTATION PROGRAM

District A

Vehicle miles with students	Vehicle miles without students	Vehicle miles nonessential	Total membership transported students
5,000	2,000	1,000	8,000

$$\begin{array}{r} 5000 \\ \times .50 \\ \hline 2500 \end{array} + \begin{array}{r} 2000 \\ \times .25 \\ \hline 500 \end{array} = 3000 \text{ miles}$$

$$\frac{8000}{3000} = 2.66 \text{ (density index)}$$

$$\frac{386.2385^{a}}{2.66} + 42.50283^{a} = \$187.70$$

Cost per student = $187.70 Total State Allocation = $1,501,600[b]

8000 miles[c] x 180 days = 1,440,000 x 1.00[d] = $1,440,000

Prorated state allocation (45% x 1,501,600) = $675,720

Local funds needed to fund district program = $764,280

[a]Constants set annually by the State Department of Education.
[b]Unprorated.
[c]Essential miles + nonessential miles.
[d]District's cost per mile.

APPENDIX E (CONTINUED)

District B

Vehicle miles with students	Vehicle miles without students	Vehicle miles nonessential	Total membership transported students
5,000	2,000	1,500	8,000

$$\begin{array}{r} 5000 \\ \underline{x.50} \\ 2500 \end{array} + \begin{array}{r} 2000 \\ \underline{x.25} \\ 500 \end{array} = 3000$$

$$\frac{8000}{3000} = 2.66 \text{ (density index)}$$

$$\frac{386.2385^{a}}{2.66} + 42.50823^{a} = \$187.70$$

Cost per student = \$187.70 Total State Allocation \$1,501,600[b]

8500 miles[c] x 180 days = 1,530,000 x \$1.15[d] = \$1,759,500

Prorated state allocation (45% x 1,501,600) = \$675,720

Local funds needed to fund district program = \$1,083,780

[a]Constants set annually by the State Department of Education.
[b]Unprorated.
[c]Essential miles + nonessential miles.
[d]District's cost per mile.

APPENDIX F

CATEGORIZATION OF FLORIDA SCHOOL DISTRICTS BY STUDENT POPULATION (1982-83)

Category	County	Student population
150,000 +	Dade	262,144.05
125,000-150,000	Broward	141,182.14
100,000-125,000	Hillsborough	119,809.59
	Duval	101,246.77
75,000-100,000	Pinellas	95,583.86
	Orange	88,342.87
	Palm Beach	80,115.38
50,000-75,000	Polk	61,540.55
25,000-50,000	Brevard	44,537.40
	Escambia	41,912.52
	Seminole	38,736.15
	Volusia	35,952.03
	Lee	33,112.15
	Pasco	29,180.00
	Sarasota	26,963.17
	Leon	25,913.20
20,000-25,000	Marion	24,447.47
	Manatee	23,337.04
	Okaloosa	23,156.40
	Alachua	23,018.47
	Bay	21,159.81
15,000-20,000	Lake	19,137.91
	Clay	17,387.75
	St. Lucie	15,000.00

APPENDIX F (CONTINUED)

Category	County	Student population
10,000-15,000	Collier	14,870.14
	Santa Rosa	12,415.00
	Osceola	10,595.40
	St. Johns	10,431.12
	Putnam	10,361.10
	Martin	10,217.63
5,000-10,000	Citrus	9,563.40
	Indian River	9,517.40
	Monroe	8,848.39
	Gadsden	8,801.47
	Charlotte	8,328.81
	Hernando	8,295.92
	Jackson	7,985.27
	Highlands	7,644.75
	Columbia	7,236.30
	Nassau	7,215.01
	Hendry	5,089.86
1,000-5,000	Suwannee	4,977.64
	Okeechobee	4,903.00
	Hardee	4,599.25
	Sumter	4,593.54
	Levy	4,390.31
	Bradford	4,377.71
	DeSoto	4,293.94
	Washington	3,962.21
	Walton	3,731.07
	Baker	3,628.84
	Taylor	3,558.10
	Madison	3,183.37
	Holmes	3,179.81
	Gulf	2,375.51
	Hamilton	2,333.31

APPENDIX F (CONTINUED)

Category	County	Student population
1,000-5,000 (continued)	Wakulla	2,481.14
	Flagler	2,277.30
	Jefferson	2,130.79
	Calhoun	2,016.43
	Dixie	1,671.49
	Franklin	1,609.63
	Gilchrist	1,513.85
	Union	1,499.75
	Liberty	1,054.57
1,000-	Lafayette	999.38
	Glades	863.56

APPENDIX G

SPECIAL EDUCATION TRANSPORTATION SURVEY

District Name:________

School Number	Vehicle Type	Length of Term	# of Handicapped Students Trans.	Total Daily Miles*
		1980		

*If you would, please fill in the information listed in the various columns. The most important piece of information is the special ed. mileage; the other items are also important, too.

APPENDIX H

BREAKDOWN OF EXCEPTIONAL STUDENT TRANSPORTATION EXPENDITURES FOR SAMPLE SCHOOL DISTRICTS FOR 1982-83 SCHOOL YEAR

	Subcosts			
County	Fuel	Maintenance	Salaries	Total expenditure
Alachua	$ 50,000	$ 30,000	$126,130.35	$206,130.35
Baker	9,581	← included	40,957	50,538
Bay	39,492.72	21,119.11	137,986	198,597.83
Brevard	reported total cost figure →			853,338.80
Broward	reported total cost figure →			2,130,495
Calhoun	396	100	2,160	2,656
Charlotte	11,587	550	24,625.80	36,762.00
Clay	44,717	20,728	149,261	214,706
Dade	reported total figure →			2,717,352
DeSoto	7,948.92	4,591.01	42,658.69	55,198.62
Duval	reported total figure →			1,557,316
Glades	3,960	2,000	5,940	11,900
Gulf	8,140.71	3,218.91	15,699.48	27,059.10
Hamilton	reported total figure →			1,663.20
Hardee	2,892.35	931.73	9,163	12,987.08

APPENDIX H (CONTINUED)

	Subcosts			
County	Fuel	Maintenance	Salaries	Total expenditure
Hendry	$ 3,592.99	$ 610.41	$ 18,002.80	$ 22,206.20
Highlands	12,349	2,093.63	27,378.71	41,822.15
Indian River	141,008.50	5,484.67	36,988.47	183,481.64
Jefferson	3,723.00	1,001.93	10,280.16	15,005.09
Madison	6,575.00	1,717	19,558.40	27,850.40
Okaloosa	reported total	cost figure →		125,575.31
Okeechobee	10,666.81	2,300.48	17,739	30,706.29
Orange	352,486.42	189,422.27	1,256.571.80	1,189,200.50
Pasco	122,400	122,400	688,092	932,892
Polk	reported total	figure →		1,135,250
Putnam	reported total	figure →		106.718.89
Sumter	3,574.80	800	14,337.28	18,712.08
Suwannee	4,066.83	← included	6,294.84	10,361.67
Taylor	12,186.40	← included	17,699.60	29,886
Union	5,241.00	4,368	6,001.15	15,610.15

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BIOGRAPHICAL SKETCH

Patricia G. Anthony was born in Washington, DC, on July 19, 1948. After graduating in 1966 from Binghamton Catholic Central High School, Binghamton, New York, Ms. Anthony attended Marymount College, Tarrytown, New York. At Marymount, Ms. Anthony earned a Bachelor of Arts degree in psychology. Upon completion of college, Ms. Anthony attended Michigan State University, graduating in 1971 with a Master of Arts degree in special education.

From 1971 to 1974, Ms. Anthony was employed by Muskegon School District, Muskegon, Michigan, as a teacher of the mentally retarded. During that time, in 1973, a daughter, Hilary Jane, was born.

In 1974 Ms. Anthony and her family moved to the Lansing area, where Ms. Anthony was employed by Waverly School District as a special education teacher. In 1976, Ms. Anthony was employed by Ingham Intermediate School District as a curriculum specialist. In this capacity she served as a member of a Title I project, whose task it was to develop and implement a curriculum for severely handicapped students.

Ms. Anthony worked on the Title I project until 1978, at which time she and her family moved to Jacksonville, Florida. One year prior to this, a second daughter, Jessie, had been born in Lansing, Michigan.

From 1978 to 1979, Ms. Anthony attempted to be content with raising children and dogs. In 1979 and 1980, Ms. Anthony was employed by the University of North Florida as an adjunct instructor for the Special Education Department.

During 1981, Ms. Anthony was admitted to the doctoral program in educational administration at the University of Florida. While working toward a Doctor of Philosophy degree, Ms. Anthony served as a research associate for the Institute of Educational Finance, where she worked as an editorial assistant on the Journal of Education Finance and assisted Dr. Kern Alexander in teaching school law.

Ms. Anthony is married to Robert A. Anthony, who is employed as an Assistant Professor of Special Education at the University of North Florida.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

S. Kern Alexander, Chairman
Professor of Educational
Administration and Supervision

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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April, 1984

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